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A JOURNEY UP THE BARAM RIVER TO MOUNT DULIT AND THE HIGHLANDS OF BORNEO.

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His Highness the Rajah of Saráwak having communicated to me the wish of the Royal Geographical Society for some account of my journey to the head-waters of the Baram and Tinjar Rivers, I have pleasure in complying with the request.

It may not be amiss to remind even a geographical audience that Saráwak is a State situated on the north-west of Borneo, ruled over by an English Rajah, Sir Charles Johnson Brooke, G.C.M.G., nephew of the original Rajah Brooke, whose career must be known to most of you. The country has been quite recently placed under British protection. The boundary of the State is Tanjong Datu, on the extreme west, long. 109° 40′ E., and the mouth of the Trusan river the most easterly point, long. 115° 13′ E., with a width of about 250 miles inland from the coast. The coast-line is 460 statute miles in length.

I may also recall the fact that in 1881 Mr. W. M. Crocker, who had been Resident of Saráwak, and whose name is intimately associated with North Borneo, read at one of the Society's meetings some interesting notes on Saráwak and Northern Borneo, which will be found in the *Proceedings* for 1881, p. 193. It will be seen from his map that Baram at that date belonged to Brunei and not to Saráwak, and that its geography was almost a blank. It is true that the Rajah did ascend the river for some distance before the province was ceded, but that was merely a running visit.

The Baram River discharges itself into the China Sea at lat. 4° 37′ 15″ N., long. 115° 59′ 30″ E. Its width at the mouth is about three-quarters of a mile, with sandspits running out on either side to the distance of 2 miles. These sandspits are washed away during the

* Read at the Evening Meeting of the Royal Geographical Society, January 16th, 1893. Map, p. 288.

north-east monsoon, but appear again in the south-west monsoon. About 2 miles out there is, unfortunately, a bar, which prevents vessels drawing more than 7 feet of water from entering the river. There is, however, fairly good anchorage for ships in the bays on each side of the Baram point, so long as the wind is north-east or south-west; but when due west there is no shelter whatever. To give an idea of the volume of water running down, I may state that it is constantly found to be fresh at the distance of 2 miles outside; and very rarely in the dryest weather the tide reaches Claudetown, a distance of 60 miles. The land on each side of the mouth consists of alluvial deposits, marshy, and covered with casuarina trees and coarse grass, the latter affording pasturage for deer and wild buffaloes. For the first 15 miles up the river the reaches are long and devoid of interest, excepting for the wonderful growth of the Nipa palms, which line the banks, growing to a height of 30 feet, and from which the natives procure both salt and sugar. The ground is covered with a network of roots, and constantly flooded, the whole country for miles being quite flat. At Pagalayan the land is a little higher, the trees being larger and presenting a more healthy appearance. At this point the depth of the river is in some places as much as 20 fathoms. For the next 15 miles the country consists mainly of grassy plains, which have been formed by the river altering its course, washing away from one side and silting up on the other. The jungle here is dense, thorny, and low, and few inhabitants are found in this locality. At the mouth of the Bakong River—a tributary—small farms have been established, and plantations of fruit-trees and cocoanut palms are dotted about wherever an acre of high land appears. A few miles farther on are lakes of no great depth or size, which have apparently been made by the overflow of the river at various times; and at one very peculiar bend of the river a canal has been cut, thereby saving about 4 miles. The first appearance of really high ground is at Claudetown, the Government station and principal town of the district, situated about 60 miles from the mouth. Here the Chinese merchants have erected magnificent shops and warehouses, and the whole trade of the river is centred at this spot—lat. 4° 3′ 15″ N., long. 114° 32′ 30″ E.

The fort, standing immediately above the river at the height of about 50 feet, commands a view of the whole township. From this spot Mount Mulu, and, indeed, the whole of the Mulu range is distinctly seen. The Government steam-launch, *Coconut*, is stationed here for up-river use; and the mail-steamer, *Adeh*, calls about once a month, bringing up supplies for the district, such as ironware, crockery, salt-fish, cotton-goods, tobacco, cloth, etc., and taking back cargoes of rattans, gutta-percha, india-rubber, beeswax, edible birds' nests, and camphor. Other steamers that occasionally call at this port are the *Sri Putri*, and the *Bujang Baram*. The *Lorna Doone* leaves mails at the lighthouse on her

journey northward. The jungle in the immediate vicinity of Claudetown is composed of hard and valuable timber, some fine specimens of which are the Meribo trees (*Afzelia palembanica*) measuring 5 feet in diameter, and sound all through. Acres of forest might be felled and conveyed to the river at very little expense. Twenty-five miles above Claudetown is the junction of the Tinjar River, the principal tributary of the Baram; the country around is flat, with dense jungle, abounding with rattans. Here the Chinese have commenced working "shingles" of ironwood, which is very plentiful.

The next place of note is the town of Long Tutau, situated at the mouth of the Tutau River. The races of people living here are the Long Kiputs and Batu Blas; and it is in this locality that the agents

SEA DYAK LONG-HOUSES.

of the various traders in Claudetown, both Chinese and Malay, congregate to barter with the tribes from the interior. Many of these traders build houses upon rafts, which are moored along the banks of the river at every landing stage. In these floating houses they live for months, and even years, until the raft is stocked with produce. They then float down river to Claudetown, sometimes bringing as many as 250,000 canes on one raft. At Long Ikang the high land appears again, mountains sloping down to the river's bank. At Batu Gading the course of the river is through a limestone district, and the scenery is very beautiful. At Long Salai the rapids commence. Here the Baram is about 100 yards across.

Passing on to Long Mari, there are numerous islands formed of pebbles, which are covered when the river is swollen, but at other times

are dry, and form a pleasing feature in the landscape. From here to the mouth of the Akar River the stream flows through a somewhat striking district. On either side are vast sandstone and shale cliffs, rising sheer from the water's edge to a considerable height, narrowing the river in places to about 50 yards. The stream rushes over huge boulders at a terrific rate, causing dangerous backwaters, and sucking down immense logs, which come to the surface at about 100 yards from where they disappear. Giham Tipang is a particularly dangerous rapid, the passing of which is accomplished at very considerable risk; the volume of water dashing over the rocks, and rising in waves 5 or 6 feet high, makes it appear impossible for a boat to pass. The "dugout," however, is tied fore and aft with rattans, and dragged through the middle of the rapids by one half of the men, the others remaining in the boat to work with poles. The noise is deafening, each man shouting at the top of his voice; and after pulling the boat for about an hour, the head of the rapid is reached, and immediately those on the rocks jump into the boat and begin paddling with all their might into some backwater for fear of being carried back over the rapid. For a moment the "dugout" scarcely moves, but at last their united efforts tell, and the boat begins slowly to make way to the nearest bank. Occasionally the current is too strong for them, and feeling themselves carried back, they jump overboard, holding on to the boat with one hand, while with the other they grasp any rock or bush that they can clutch, thus arresting the boat. One of the party then takes a turn with the rattan round the rock, and so makes it fast until they can start again. Sometimes there is nothing to catch hold of, and then, seeing it hopeless to fight against the stream, everyone turns round in the boat, and seizing their paddles and poles, they allow the vessel to shoot over the fall into the seething waters below. The sensation is undoubtedly singular, but it does not last long. The boat is bumped about in all directions, and carried on at a tremendous rate for a few seconds, the water leaping in on either side and the men *kicking* it out continually with one foot. The moment they are over, the vessel quietly glides round to the nearest back-water, and once more you draw your breath freely. Having thus escaped, they smoke a cigarette before making another attempt to drag up the boat.

The soil at the mouth of the Akar River is very fertile, and the mountain scenery is lovely. From here to the mouth of the Salaän River the banks are covered with extensive groves of fruit-trees, many of them unknown to European taste, but including also such as Durian, Mangosteen, and thick-skinned oranges. A beautiful palm-tree, called by the natives "Ijook" (*Arenga saccharifera*), is very abundant in this locality. Passing the mouth of the Salaan, the rapids become less frequent, and the country being more open, one appears to have passed through the mountain-chain. The river is clear and perfectly smooth. At the mouth of the Libbun, however, one meets again with waterfalls

which make the entrance of this river almost impracticable. Looking at the country round, the district known as the head of the Kayan River comprises one vast chain of mountains, mostly having table-land at their summits; and roughly judging, I should say from 5000 to 8000 feet high. On the other side, known as the Kalabit district, grassy plains extend for miles, which are very unusual in Borneo.

The Baram, Rejang, and Batang Kayan Rivers have their sources within a comparatively short distance of each other, as will be seen on the map which I have prepared.

I may here mention that the total revenue of the State of Saráwak in 1891 was $417,123·96, and the expenditure $417,487·46; the trade returns for the same year were as follows:

Imports.			Exports.		
	Tons.	Value in Dollars.		Tons.	Value in Dollars.
Foreign . . .	35,794	1,602,075	Foreign . . .	36,674	1,939,884
Coasting . . .	26,792	784,735	Coasting . . .	38,471	709,996
Total . .	62,586	2,350,810	Total . .	75,145	2,649,880

I will now give a short account of the journey which I made to Mount Dulit.

On September 14th, 1891, in company with Mr. A. H. Everett, I chartered the steam-launch *Coconut* to convey us and our men as far as it was possible for a small steamer to proceed up river. The nearest route to Mount Dulit is up the Tinjar. This river we entered after about four hours' steaming from Claudetown, and it was not until the following day that it was necessary to take to our "dugouts" (boats most suited to the rapids we should pass), having covered a distance of 90 miles. The following day we paddled as far as the Barawan village of Long Pruan, where we rested for the night, in the house of a man named Taman Liri, who is chief of the Barawans and the Government tax-collector.

On September 16th towards nightfall we reached Long Tisam. Within an easy walk from this village, the Central Borneo Company have commenced working a deposit of sulphide of antimony, which, so far, has been spoken of favourably. We spent the night in the house of one Avan Avit, also a Barawan. Being somewhat fatigued we retired early; and it was not until the next morning that I discovered, at the head of my bed, a large box which I had not noticed the night before, and which proved to be a coffin; and on inquiry I was informed that it contained the mortal remains of the chief's wife! As this may appear strange, I may as well explain that it was the custom of these people to keep a corpse in the house for three months before burying it. They make a large coffin of soft wood, and decorate it with various colours,

obtained from the juice of roots, the whole being elaborately carved. The lid of this coffin is rendered air-tight with a resinous substance procured from many of the Borneo forest trees, and generally known as "dammar." A bamboo about 20 feet long and 3 inches in diameter is then prepared by boring through the joints, so as to form it into what it is really intended for, a sort of drainpipe. One end of this pipe is driven into the ground, the other end is brought through the floor of the house, and inserted in the bottom of the coffin. During the first week after the body has been placed in the coffin, a large torch is kept burning day and night at the head and foot. After about three months a mausoleum is prepared, which is made of hard wood called billian, and raised about 12 feet off the ground on two massive pillars carved with various artistic designs, and figures of men and women. The body is then removed from the house and conveyed with much ceremony to this tomb. Everyone present sends one or more cigarettes made of native tobacco, wrapped in the dried leaves of the wild banana (Pisang Utan) to their dead relatives in "Apo Leggan" (Hades). These cigarettes are placed on the top and around the coffin; and, should the body be that of a man, his weapons, tools, and a small quantity of rice, with his "priok" (cooking-pot), are deposited in the tomb with him that he may be able to continue his daily pursuits in the other world. But if of a woman, her large sun-hat, her little hoe—used for weeding in the paddy fields—her beads, earrings, and other finery are placed with her body, that she may not be found wanting on her arrival the other side of the grave. The earrings are especially important, and are usually made of brass or copper, weighing sometimes as much as two pounds each. The lobe of the ear is pierced when the child is about eight months old, and earrings weighing about two or three ounces apiece are hung in the ear This weight gradually drags down the ear-lobe to a great length, and adding weights yearly as the child grows, by the time she has come to maturity the ears will reach her breasts. I have seen a girl put her head through one of these elongated ear-lobes.

I was once present when the corpse of a boy was being placed in the coffin, and I watched the proceedings from a short distance. As the lid of the coffin was being closed an old man came out on the verandah of the house with a large gong (Tetawak) and solemnly beat it for several seconds. The chief, who was sitting near, informed me that this was always done before closing the lid, that the relations of the deceased who had already passed out of this world might know that the spirit was coming to join them: and upon his arrival in "Apo Leggan" they would probably greet him in such terms as these: "O grandchild, it was for you the gong was beating which we heard just now; what have you brought? How are they all up above? Have they sent any messages?" The new arrival then delivers the messages intrusted to him, and gives the cigarettes as proofs of the truth of what he says. These cigarettes

retain the smell of the hands which made them, which the dead relations are able to recognise.

There is another strange ceremony at which I was once present, called "Dayong Janoi," in which the dead are supposed to send messages to the living, but to describe it would take up too much of this paper. It proves, however, that "spiritualism" is of very ancient practice among the Kayans, but it would perhaps be interesting to mention the various abodes of departed spirits, according to Kayan mythology. "Laki Tengangang" is the supreme being who has the care of all souls. Those who die a natural death, of old age or sickness,

NATIVE BRIDGE, BORNEO.

are conveyed to "Apo Leggan," and have much the same lot as they had in this world.

"Long Julan" is the place assigned to those who die a violent death, *e.g.*, those killed in battle or by accident, such as the falling of a tree, etc. Women who die in child-bed also go to "Long Julan," and become the wives of those who are killed in battle. These people are well-off, have all their wants supplied; they do no work and all become rich. "Tan Tekkan" is the place to which suicides are sent. They are very poor and wretched; their food consists of leaves, roots, or anything they can pick up in the forests. They are easily distinguished by their miserable appearance. "Tenyu Lallu" is the place assigned to still-born infants. The spirits of these children are believed to be very

brave, and to require no weapon other than a stick to defend them against their enemies. The reason given for this idea is, that the child has never felt pain in this world, and is therefore very daring in the other. "Ling Yang" is the place where people go who are drowned. It is a land of plenty below the bed of the rivers, and these are the spirits upon whom riches are heaped in abundance, as all property lost in the waters is supposed to be appropriated by them.

But to return to my journey. On the 17th I reached Long Sukong, at which place the rapids commence; and having procured some fresh boatmen we poled as far as Long Masso, where we arrived next day, and spent the night at the head of a rapid. The following day brought us to Long Kapa, which was as far as we could proceed by boat. From this point Mount Dulit stood out very clearly, and having taken my bearings before nightfall, in case the mountain should be enveloped in mist the next morning, we passed the night in the house of one Aban Lia, a chief of the Sibops. These people are skilful in the use of the blow-pipe (sumpitan), and by use of this weapon numbers of monkeys are killed, from which the Bezoar stones are obtained. These stones are held in great estimation by the Chinese, who purchase them readily at a high price, for using as medicine for all kinds of ailments. They are reported to be found both in the intestines and in the gall bladder of the monkey. They are of various dimensions, usually flattened in shape, somewhat oval, from the size of a pea to that of a hen's egg—the largest realising from $20 to $25. The monkeys in which these stones are most commonly found are the "Semnopithecus rubicundus," and "Semnopithecus hosei." A softer form of this stone is also found in the porcupine (*Hystrix crassispinis*). These animals are shot with poisoned arrows, blown from the sumpitan by Sibops and Punans. Sometimes the poison loses its virulence when not quite fresh, and an animal will then carry away the arrow, although it may have pierced its body to the depth of 2 or 3 inches, and it is easily broken off in the animal's movement through the jungle, leaving the poisoned end in the body. Monkeys have been shot, in whose bodies a broken piece of an arrow has been found, covered with a coating of the substance called "Bezoar" stone. The localities mostly frequented by these monkeys are the spurs of large mountains and salt springs, which are common in the interior.

At daybreak we commenced our overland journey, and I was agreeably surprised at the favourable nature of the country, as we met with no swamps, and not very thorny jungles. Having crossed the heads of many small streams, which doubtless have their sources on Mount Dulit, we came to a small hill of about 500 feet, over which we crossed, and before night came on we arrived at a point which proved to be the foot of Mount Dulit.

Next morning, September 21st, we began the ascent of the mountain,

which for the first 1000 feet was very gradual, and at 2000 feet we agreed to make a hut, which would form a storehouse for our rice, etc. This we completed in daylight, and we passed the night there. The following day I sent back all the party except two to fetch the rice and other stores which we had been unable to bring, and they returned next day, each carrying a load of about 40 lbs. Two more journeys back had to be made before all our stores were brought up, during which time I, with the two who remained with me, cut a track to the height of about 4000 feet. Having cleared away the thorns, and constructed rattan ladders in the precipitous places, we returned to the hut, which I shall hereafter refer to as "the store."

I now divided up the party, and taking five men to the altitude of 3500 feet, directed them to make another hut, on a lovely spot just over a cascade, the fall of which was about 30 feet. This spot commands a magnificent view of both Mount Kalulong and Mount Tamuduk. I then returned to the store, leaving the men at the higher elevation to shoot what birds and other creatures they might find. The men at the store I found making preparations for the construction of various kinds of native traps called "jerat." The men visit these traps night and morning, and numbers of animals and ground birds are caught by them. Those most frequently trapped are the little moose deer, *Tragulus napu* and *Tragulus javanicus*, and of the carnivora, *Viverra tangalunga*, *Hemigale hardwickei*, *Felis bengalensis*, *Felis planiceps*, and my new species of "Hemigale," which has been lately described by Mr. Oldfield Thomas as *Hemigale hosei*, was also obtained by one of these traps.

During the next few days I was constantly between the two huts, working one party against the other with the reports of the success each had met with, and late at night I was employed in giving directions as to skinning and drying the specimens obtained. The humidity of the atmosphere made it difficult to keep the skins in good condition, and the want of sun made it impossible to dry them otherwise than by fire. The men showed in many ways that they were interested in the work almost as much as myself, and great was the excitement when the first Bulwer's pheasant (*Lobiophasis bulweri*) was brought in, having been shot by a man at the lower range. This bird we had all seen on several occasions, and heard its curious harsh note constantly around us.

The next morning the men at the higher ground shot a black kijang (*Cervulus muntjac*). The colour of this animal was much like that of a common deer (*Cervus equinus*), and not the least like the common muntjac. It had two tufts of black hair above the eyes. Considerable discussion ensued as to the probability of its being a new species. I took care to preserve the bones, placing them inside the skin for comparison with others. Birds of gay plumage unknown to me were shot daily, and on the 20th I was fortunate in procuring the new specimen which has been described by Dr. R. Bowdler Sharpe as

Calyptomena hosei. This bird was making a noise resembling that of a dove. On the morning of the 25th I had the pleasure of securing a beautiful little barbet, which also had been described as a new species (*Mesobucco eximius*).

The following morning we moved our camp to 4000 feet, and brought down the specimens which we had collected to the store. On the night of October 8th a terrible storm burst over the mountain, and gigantic trees came rolling down the sides carrying all before them; the roar and crash of falling timber made one feel the necessity for great care in the selection of a spot for an encampment, as the fall of some of these huge trees carries large boulders with them, which greatly increases the danger. During the continuance of the storm we all felt very uncomfortable, and decided that it would be best for us to move our camp. Luckily we had taken the precaution to fell the trees that were near, so that we escaped injury. When morning came the storm had spent itself; the mountain stream had become a small river, with waterfalls from 50 feet to 70 feet drop. The noise of one of these near the hut made it impossible to hear oneself speak except by shouting. This stream the day before was so small that we had made spouts of bamboo to lead a few drops of water into a jar that we might procure enough to drink, while now the spray from the fall reached the hut, a distance of about 40 feet.

Early next day I ventured to climb a white sandstone cliff which was directly above us, and was rewarded for my trouble by finding many things of interest. Having scaled this by means of rattan ladders and cords, we came upon a large cave with a long ridge of overhanging rock; the soil underneath this ridge was very dry, but to the surprise of every one, tobacco was found growing in large quantities. We picked some of the leaves, which measured 6 inches across and 13 inches long. This wild tobacco, which appeared to be flourishing, was growing at an altitude of 4150 feet. The Punans, a race of people which live in the jungle, more like animals than human beings, having no houses, cut the leaves of this tobacco into fine shreds while it is still green, and then dry it in the shade. This when sufficiently cured is made into cigarettes. The Punans state that they gather this tobacco two or three times a year, and that it was originally planted by the spirits.

We passed on over great boulders and into the cave, hoping to find some nests of the esculent swallow, which are usually met with in such places. The mouth of the cave was small, and many beautiful ferns and other plants covered the rocks. I collected here several kinds of ferns which I had not met with before; these I sent to Kew. One especially noticeable had a frond 14 feet long. During the time I was looking for ferns, etc., the men were preparing torches made from the bark of the maranti tree, into pieces, of which a kind of gum is inserted, which burns brightly. We then entered the cave, which was very damp and

cold; the continual drip of water from the top, and rush of wind through the cave was very disagreeable. We searched about for some time, and found nothing but a prettily marked snake about 6 feet long, and unlike any of those of the low country. As yet I have not ascertained its name.

We afterwards came upon small bones of birds and animals, which had most probably been killed by the snake. As we proceeded further in, we found small caves and passages on either side, which gave the place a very weird appearance. Turning down one of these passages, we heard in the distance a strange rumbling sound, which caused us all to start, and waving our torches to get a better light, we went on in the direction of the noise to find out the cause. As we got nearer, the sound increased, and we stood still to listen. At this moment multitudes of bats (*Rhinolophus luctus*) flew into our faces, and for an instant we were at a loss to know what had happened. The noise continued, and on approaching a little nearer, we discovered the cause. A small stream of water, from a fissure in the roof of the cave, falling into a deep chasm below, caused a remarkable echo, which was repeated again and again along these passages. We perceived a small streak of daylight overhead, but finding no other way out, we retraced our steps to the entrance, and were glad to get once more into fresh air. We brought back some of the bats, which we had knocked down, and having climbed about 400 feet higher, commenced building another hut, which was finished before dark, leaving us time to return to the camp in daylight. It had been a successful day for everyone. Each man had shot three or four birds, and I had secured a pretty little squirrel with white ears (*Sciurus whiteheadii*).

The next day, Oct. 12th, I took the dry skins down to the store, and the baggage was moved to the new hut at 4500 feet. I returned at night after a hard day's walking, first down and then up the mountain. The new spot appeared to be well-chosen, as on this day the best collection of birds was secured, among which were the following:—Two *Allocotops calvus*, male and female; one *Artamides normani*, two males of *Pitta schwaneri*. Three squirrels, *Sciurus brookei*, and one *Calyptomena whiteheadi*.

The fauna of Mount Dulit resembles that of Kina Balu in a great number of instances, but it is a curious fact, that all the species above 2000 feet are found at a higher altitude on Kina Balu than they are on Mount Dulit. This I think can be accounted for by the fact, that Mount Kina Balu has been cleared of all the old jungle, and farmed by the natives to a height of about 2000 feet, whilst at Dulit there are no traces of human habitation within miles of the mountain. I think it is reasonable to suppose that many of the Kina Balu birds and animals, which prefer to live in the old jungle, have been in this way driven to a higher elevation.

On October 13th we climbed to the summit and found the altitude registered by my aneroid to be 5090 feet. From this spot we obtained a magnificent view of the distant mountains Mulu, the position of which is lat. 4° 0′ 15″ N., long. 114° 57′ 0″ E., and, nearer to us, Batu Song with its curious dome-shaped top; Kalulong standing out boldly on the right showing its two high peaks, which seemed no great distance from us. Looking over the Batang Kayan district one sees a vast chain of flat-topped mountains, with one much larger than the rest towering above them, and which I should say was probably 10,000 feet high. Mount Tamuduk, at the head of the Baram River, appeared through the mist, which prevented us from clearly distinguishing its shape. It has, however, a flattened top, and is, as far as I could judge, 7000 or 8000 feet high. The wind and mist driving past on Dulit's summit reminded us of a cold, bleak November morning in England. I spent some time in taking the position of these mountains, which I have worked out as follows:

	Latitude.	Longitude.
Kalulong	3° 7′ 0″ N.	114° 13′ E.
Mulu	4° 0′ 15″ N.	114° 57′ E.
Lambir	4° 13′ 0″ N.	114° 0′ E.
Tamuduk	3° 12′ 0″ N.	114° 33′ E.
Pamabo Range	3° 1′ 0″ N.	114° 55′ E.
Batu Song	3° 42′ 0″ N.	114° 37′ E.
Subis	3° 48′ 0″ N.	113° 47′ E.

We then began to crawl about and find our way through the moss, which covered the top of the mountain to the depth of 2 or 3 feet. Each tree had cushions of moss round it, and archways of moss met us in all directions; and everywhere was saturated with moisture. The trees are small and stunted, the highest being only about 20 feet, and about 6 inches in diameter; scanty and with very few leaves. The most striking are the casuarinas, which were growing abundantly on the bare rock, and glistening with the sunlight upon them. Here we found many varieties of Nepenthes of various hues and forms, and also several small and pretty flowers, amongst which I found some resembling closely our violets and primulas. Dendrobiums were plentiful on the trees. I was surprised to find the top of Mount Dulit was so flat, and on reaching the other side, looking down over the Balaga valley, some mountains at the head of the Rejang River were visible, but the mist had now become so dense that we could see but little. We obtained a few birds, and returned to the hut. The next few days were spent in collecting any specimens we could, amongst them a new Trogon, which has been described by Mr. R. O. Grant as *Harpactes dulitensis*. This, with *Heteroscops luciæ*, was shot just below the summit, 5000 feet.

On the evening of October 16th I resolved to make our final camp upon the very summit, and next morning I again went to the top.

Passing along the ridge we pitched upon a spot that seemed favourable, and commenced making a hut, but owing to the trees having no leaves of any size, we were at a loss for materials for a roof. I had, however, brought one small Kajang or leaf-mat with me, expecting some such difficulty, and we managed to pass the night under it; the rain incessantly pouring down, and the position being so cold and wet that sleep was out of the question for any of the party.

We managed to keep fires alight all night, and sat through the dreary time anxiously waiting for daybreak. No one can form a correct opinion of what the shape of Mount Dulit really is until it has been seen from the top. It is evident that this vast table-land provides a home for many living creatures, that would not probably be found on a mountain whose sides were steep and ending in a peak.

On October 18th seven Punans, a tribe residing near the Parah River, on hearing shots, came up to our hut. These are the only natives that ever ascend the mountains of their own accord, and they only in search of india-rubber and camphor. They told me that they had been working in the jungle and recognised me the day before, although we had not seen them. I gave them presents of tobacco, etc., which they much appreciated, and they left us.

The following morning they returned, bringing with them three more, telling me that if I was collecting specimens, they would be willing to assist me with the blow-pipe, ("sumpitan"—or as they call it, "put"). They brought with them a fine monkey (*Semnopithicus rubicundus*) and a horn-bill (*Buceros rhinocerus*), which they had shot with this weapon on their way. I was very glad of their assistance, and they remained with me and procured many valuable specimens both of birds and mammals. One morning one of my Dyak hunters returned, declaring that he had heard a tiger. Being very unwilling to believe this, and wishing to convince them that no tiger exists in Borneo,* I took a Dyak and two Punans with our guns, and having walked half a mile in the direction pointed out to us, we heard a strange booming noise, very loud it is true, but not much resembling the roar of a tiger. I asked the Punans what they thought it was, and they replied "Jawi," toad. As we came up to the spot, the noise seemed to resound through the rocks, and sure enough, between the crevices, was a toad of gigantic size, bellowing lustily. As we tried to catch him, he backed further into his hiding-place until he was out of reach, and we were obliged to give up the hope of securing him; but a few days afterwards we procured a fine specimen of this toad, which measured 14½ inches round the belly, and 3 inches across the head. It had a hard, rough black skin with warty excrescences on the back. These warts contain a poisonous

* I am not aware that a tiger has been found in Borneo, although the skull of one is reported to be in the house of a Singgi Dyak in Upper Saráwak.

fluid, some of which a Punan took, and placing it in the toad's mouth, destroyed the creature, and its skin is now in the British Museum.

I began my descent of the mountain on October 26th, and was glad of the assistance of these friendly Punans, who helped us to carry down my collection. On reaching the store, we packed up and rested there for the night. Next morning we had to travel slowly as the packages were very heavy, and stopping to rest for a short time at a deep pool beneath the waterfall, 1500 feet above the level of the sea, I found that the pool contained small fish (*Gastromyzon borneensis*) which were causing curious marks upon the stones at the bottom. These marks were produced, I found, by the fish adhering to the stone by means of a sort of sucker on its breast which prevented it being washed away by the force of the stream. We tried to catch them for some time with our hands, but without success, when an ingenious Dyak produced a piece of thread, which he tied on the end of a stick, and with a small piece of brass wire which he bent into a hook, it looked as if he meant business. We then searched for worms but found none. The Dyak, however, was not going to give up so easily, and sitting down on a stone, he proceeded to take out his knife and cut small pieces off the sole of his foot! with which he baited the hook, and was not long before he landed a fish, which was, doubtless, unable to resist so tempting a bait. We now all made similar hooks, and applied to our friend for bait. Having caught about half-a-dozen of these fish, I put them in spirit and continued our journey.

In the evening we arrived at the house of Aban Lia, and on going inside I found a musician seated in the middle of the verandah surrounded by an audience of about forty persons. The instrument which he was using was a flute (*silingut*) made of bamboo, on which he played not in the usual way with his lips, but through his nose! The notes produced were softer and clearer than the ordinary flute (*ensuling*) which is played with the mouth, and the man was certainly a skilful performer. Finding, however, that much of his wind escaped through the other nostril, he tore out the lining of his pocket and blocked the offending outlet with a small plug of rag. He assured me that his nose, which was undoubtedly a musical one, was slightly out of order, as he had only just recovered from an attack of influenza, but that sometimes he was able to move his audience to tears.

Next day we paddled down river over the rapids, and continuing our journey through the night, arrived at Claudetown on the evening of the following day, having spent a very enjoyable, and on the whole successful, six weeks in the Highlands of Borneo.

The jungle products of the Baram River are, rattan, gutta-percha, indiarubber, beeswax, camphor, and edible birds' nests. The minerals found in the district are gold, cinnabar, silver, antimony, iron, coal and precious stones.

There are sixteen dialects spoken in the Baram district, the most important being Kayan, Kenniah, Punan, Kalabit, Narom, Sibop, Brunei Malay, and Malay.

I subjoin ten words as an example :—

English.	Kayan.	Kenniah.	Punan.	Kalabit.	Narom.	Sibop.	Brunei Malay.	Malay.
Wild pig	baboi .	bawi .	bakas .	bakar .	san .	bakas .	bai .	babi utan.
Man .	daha .	kalunan	ulun .	lumulun	ideh .	ulun .	jilama	manusia.
To walk	panoh	massat	malakau	nylan .	malahau	malakau	jalan .	jalan.
A fish .	masik	siluang	luang .	luang .	futar .	enjin .	lauk .	ikan.
Dog .	asau .	asu .	asoh .	uteh .	ou. .	asu .	koyuk	anjing.
Water .	atar .	sungei	bah .	fah .	fer .	bah .	aying.	ayer.
Good .	sayoh	layar .	dian .	dor .	jeh .	dian .	bisai .	bagus.
No . .	nusi .	naan	bi . .	naam .	naan .	abi .	nada .	tida.
A fowl.	yap .	manok	deek .	lual .	aal .	deek .	manok	ayam.

After the reading of the paper the following discussion ensued :—

Dr. Bowdler Sharpe : I have before now been asked to speak a few words on those occasions when travellers come home, and not only delight the Geographical Society with an account of their journeys, but have also been known as contributors to the national collections in the British Museum. From a naturalist's point of view, I am seldom able to speak very well of the results which attend British expeditions to foreign countries. If it is a German expedition or a French expedition we always find that the Governments of those countries consider it necessary to attach to them a competent naturalist, and I yet hope to see the English Government alive to the necessity of following the example of other nations; but, luckily for England, we possess in the service of our chartered companies and in the service of native Governments, such as that of the enlightened Rajah Brooke, young Englishmen who make up for these deficiencies on the part of our own Government : such for instance are Mr. F. J. Jackson, of the Imperial British East African Company, and Mr. H. H. Johnston, the Commissioner for Nyasaland, who has been most energetic, as most of you know, in sending from his new province to the British Museum wonderful collections of the natural history of those countries which he rules over. Here is an instance in which, thanks to the energy of an Englishman, the country does not suffer in the way of science; and we find the same result when such a ruler as the Rajah of Saráwak encourages energetic men, like our friend Mr. Hose, not only to explore the district over which he rules, but to make collections of the animals and plants of the country. This Mr. Hose has done, and although we have not heard much of it in the paper, I trust I may be allowed to have two minutes to tell you some of the results of Mr. Hose's energetic collecting in these wild countries, and the importance of them I can easily demonstrate. A few years ago a young Englishman, Mr. Whitehead, on his own account and after great difficulties, managed to ascend the great mountain of Kina Balu, high up in the north of Borneo, and from there managed to get a wonderful number of new animals, birds, and insects. We were well acquainted with the ordinary forms of animal life of the lowlands of Borneo, which are very similar to those of the lowlands of Sumatra and Java and the Malayan Peninsula; but when once Mr. Whitehead got above 3000 feet on this mountain, he discovered something

totally different, something totally unexpected—we were face to face in Borneo with a Himalayan fauna, a fact of tremendous interest. We thus found that the fauna of the Himalayas extended through the high mountains of the Malayan Peninsula from Tenasserim to the high mountains of Sumatra, and continued once more into the highlands of Java and Borneo. To Mr. Hose is due the fact that we know that this Himalayan fauna extends in the highlands of the latter island to an extent before unexpected. In this expedition, which he has so modestly referred to, he has discovered some new forms of animal life which have carried our knowledge of this Himalayan fauna much further than before. That, in a few words, I think sums up the results of Mr. Hose's scientific work. I cannot tell you of the numbers and the importance of the species he has discovered; but it so happens that one of his most beautiful discoveries has been taken for me as illustrations to one of my lectures, and I have taken the liberty of bringing some slides for exhibition.

Loriculus, or Hanging Parrakeet.—I. The connection between the Malayan, Javan, and Sumatran is easily shown by certain forms of bird-life, and *Loriculus* is one of the forms which mark the connection with the Indian fauna. These little parrakeets are no bigger than a sparrow. II. In the honey-guide (*Indicator*) we have a bird once more occurring in Borneo and the Malay Peninsula, and although it is poorly represented in these Malayan countries, it is well represented by six or seven species in Africa. III. This is one of the ordinary Broad-bills (*Eurylæmus*) of the low countries, where side by side with it is found another little green bird called a *Calyptomena*. When Mr. Whitehead went up Kina Balu he came upon a splendid bird there which I called after him, *Calyptomena Whiteheadi*; but Mr. Hose, on this mountain Dulit, has not only found this extraordinary bird, but has been so fortunate as to discover another species of the genus, which I have named after him, and it is one of the most remarkable birds we know, on account of its combination of colour. The other species of *Calyptomena* are green, but Mr. Hose's has a light blue breast; and, as if that were not enough, we find on closer examination that at the side of the tail it also possesses more bright blue feathers, generally hidden by the green of the rest of the plumage, and evidently intended as an extreme form of ornament, as it is only found in the male bird. In these few words I hope I have shown you that, in addition to the geographical discoveries, Mr. Hose has also contributed greatly to our knowledge of the fauna of the country he has travelled over.

The PRESIDENT: I think we have had a very agreeable evening. We are extremely obliged to Mr. Hose for his paper, and to Mr. Seebohm for having read it. Mr. Hose has also introduced a very admirable innovation by exhibiting his skill upon various musical instruments. I am afraid we shall not be able to insist upon all the readers of papers also playing the organ. Mr. Sharpe's remarks were, as they always are, very much to the point, very informing and very valuable. You will, I know, desire me to thank every one of the gentlemen I have mentioned in your name and in my own.

Mr. HOSE'S MAP.—The coast-line of the map has been taken from the latest Admiralty charts. The summits of the principal mountains have been verified by Mr. Hose and the position of others obtained by bearings and distances. The rivers and paths have been inserted from sketches made by Mr. Hose on the spot when frequently travelling over the same ground. All the positions given in the paper have been embodied in the map.

EXPEDITION UP THE JUB RIVER THROUGH SOMALI-LAND, EAST AFRICA.

By Commander F. G. DUNDAS, R.N.*

The River Jub, which I navigated in 1891 for 400 miles, discharges its waters into the Indian Ocean, on the East Coast of Africa, in lat. 0° 14′ S., long. 42° 38′ E., almost on the Equator. Its lower course is in a southerly direction; the upper part of the river has not been explored. It probably rises in the mountainous region of Abyssinia. As it is the actual boundary between the British and Italian spheres of influence in East Africa, it is of considerable interest, as also in connection with the ill-fated expedition of Baron von der Decken. In August, 1865, he ascended this river in his steamer the *Guelph* (having lost one steamer on the bar at entrance) to the rapids above Bardera, where the vessel was wrecked, and the Baron, with five of his European colleagues, was murdered by the Somalis, two only effecting their escape No further details have ever transpired in connection with the fate of this expedition, I being the first European who has been to Bardera since the catastrophe. The narrative of Von der Decken's expedition is well known. I hope during my recent journey that I have added something to the present knowledge of this highway to the populous districts of the Gusha territory and the rich tracts of the Boran country.

Colonel Chaillé Long, on behalf of the Egyptian Government, is reported to have made the ascent of the river for some 100 miles; but although Von der Decken's expedition was remembered and spoken of by the natives on the river, nothing was known of any other European having ever been seen. I may here recall the fact that I commanded the expedition fitted out by the Imperial British East Africa Company for the exploration of the River Tana, and the unexplored region about Mount Kenia in 1891, an account of which was read before this Society in a Paper compiled from my Journal by Mr. Ernest Gedge in April last.

Whereas the course of the Tana is almost entirely confined to the countries of the Wapokomo and Wakamba tribes, who are quiet and peaceful, the River Jub flows through the territories of the powerful and hitherto dreaded Somalis.

The stern-wheel steamer *Kenia*, belonging to the Imperial British East Africa Company, in which I made the ascent of both rivers, is 86 feet in length, with 23 feet beam, drawing 2 feet 6 inches loaded, having six compartments, with an upper deck, and deck houses fitted with wire

* Read at the Evening Meeting of the Royal Geographical Society, December 19th, 1892. Map, p. 288.

gauze mosquito frames, and an awning deck over. The armament is two new pattern Maxim-Nordenfelt guns.

We arrived off the bar in tow of ss. *Juba* on April 25th, 1892. This was the second attempt, as the weather, through the unusual strength of the north-east monsoon, was very bad; and the vessel nearly foundered on the first occasion. We now succeeded in crossing the bar, which, owing to the necessity of a vessel being exposed broadside on to the heavy rollers, is most difficult and dangerous. There is a depth of only one fathom at high water, which varies but slightly with spring and neap tides. The numerous sharks and crocodiles about testified as to the fate which might have been expected had the vessel struck. Turning into the river from a north-east to south-west course in calm weather we found a broad majestic stream about 250 yards wide, with a current running 2½ knots, though at the narrow entrance it was much accelerated. The right bank was all low sand-hills, with a few bushes; the left wooded, with high red sandstone hills in the rear, studded with thorn bushes. On the bank were piled up trees and snags brought down by the current and lying in masses extending some little distance from the river.

Passing up in the *Kenia* I arrived at Gobwen, a small village 2½ miles from the mouth, having two very ancient Arab forts almost in ruins, one on either side. On the left bank parts of the old wall which encircled the village and fort still remain. The only inhabitants now are the Kirobotos, natives of Muskat, some of the Sultan of Zanzibar's soldiers who occupy these forts.

The mouth of the river, although inaccessible to ocean vessels, is distant only 10 miles from the safe harbour of Kismayu, with which it can easily be connected by an inexpensive tram-line. Kismayu Bay was surveyed by Captain Wharton, of H.M.S. *Fawn*, in 1874–75. It is especially important as being the northernmost and only harbour along the entire eastern Somali coast available for ocean steamers during the south-west monsoon, which blows from April to October. During this period the northern parts of Brava, Merka, and Magadishu are closed, and trade, consequently, with them entirely suspended.

The *personnel* of my expedition consisted of twelve Zanzibarris (the crew), one Goanese engineer, one Hindu, and one Chinaman (carpenter); twelve Askaris (native soldiers undrilled), and fifteen native porters for cutting and carrying fuel. I arranged to make a start up the river on May 2nd, but before that date received intelligence from the Arab Akida of the fort that the Somalis were massing all round, and that evidently something was about to happen. I had noticed for several days the hills in the distance covered with black moving masses of natives. On the morning of the 2nd, having ordered steam at eight o'clock, I saw both banks and neighbouring hills one black mass of Somalis, somewhat relieved by their white cloths, all

armed with spears and the short stabbing knife which every Somali carries. Large bodies were to be seen moving through the bush and thorn trees, coming abreast of the vessel, chanting a kind of dirge which I understood afterwards was their war-song. Still I had no communication with them. My Arab serang rushed up on to the awning-deck to me, saying all the crew had deserted. Then I descried two canoes arriving at the bank with my men, who were kneeling or grovelling on the ground kissing the Somalis' feet in abject terror. Of my caravan camped on the bank, all had bolted except the headman. Seeing several chiefs together seated under a thorn-tree I landed in a canoe, and going up to them asked what was the cause of all this trouble, and why all these people had assembled. They informed me that I was to take the ship out of the river, as no leave had been given for a vessel to come in. If I moved they said there would be war, and they would kill me.

I learnt afterwards that 400 Somalis were stationed, concealed in thick bush, at the bend of the river, where the water was shallow; and they expected the vessel to ground, when they would have attacked her. Eventually after much talk, I agreed to remain fourteen days, and they on their part consented to forward a letter from me to Murgan Usuf, the Sultan of the Ogaden Somalis, who was the head chief, and lived at Uffmadu, six days' journey from the coast. On the fourteenth day I received a reply from Murgan, saying that he was coming down to see me with a large following of 6000 men, and that I must feed them. I replied that I would be glad to see him, but that having no food he had better leave his retinue behind him. I then went down to Mombasa to see Mr. Ernest Berkeley, the Administrator of the Company, who returned with me. Aided by his admirable administrative capabilities, and untiring zeal and tact, I succeeded in concluding a peace with Murgan Usuf, who granted permission for the vessel to proceed. That gentleman, looking round the *Kenia*, espied my sword hanging in the cabin; he said he would have that as my present to him, and quietly appropriated it along with an arm-chair which he took a fancy to. He is a tall, powerful, handsome man, exceedingly sharp, and with a remarkable memory.

On July 23rd, having laid in a large supply of wood for fuel from the piled-up trees at the mouth of the river, we started at 8 A.M. on my voyage up the river. For the first eight miles there were large undulating plains interspersed with woods and numbers of Mkono palms, the fan palms growing close to water on the bank. The depth of water varies from 2½ to 3½ fathoms. At noon I arrived at the first large Somali villages of Hajowen and Hajualla, situated nearly opposite each other, with populations of about 900 each. As we came alongside the right bank at Hajowen the natives crowded down to look at the vessel. The Somalis, as is well known, are a very fine handsome race,

of good physique, with excellent features; the hair is very thick and sticks out like a bush, but is parted in front. The younger girls and women are mostly pretty with splendid black eyes, but are jealously guarded by the men; a Mzungu or European is hardly permitted to look at them. The Somalis are very strict Mohammedans. I noticed numbers of Galla girls about who are slaves, the lighter colour and different features marking them out from the Somalis, who are very black. The missionary Krapf reported, in 1849, having heard in Shoa of a tribe of Christian Gallas living near the equator. It is a curious fact that many of the slaves of the Somalis, whose mothers or grandmothers were Boran women captured by the Somalis, wear, as an ornament, a white round shell or stone having a black leathern cross upon it. I am informed that when the Company's Administrator first visited Kismayu and opened negotiations with the colony of runaway slaves at Gosha, he then heard of a Christian tribe of Gallas who were anxious to get into communication with the Company and to have access to the coast.

Leaving these villages, the only large Somali villages on the river from the mouth to Munsur, 360 miles, and Bandera, 387 miles, I went on up the river. The country still showed large grass plains with occasional wood. Later in the afternoon, seeing large herds of game feeding, I made fast to the bank, and going after them was fortunate enough to secure two Topè, a very large species of reddish antelope with sloping horns. The meat was excellent.

The next day, Sunday, we pushed on, the river mostly running through wooded reaches and jungle. Seeing as I thought another river running nearly parallel about a quarter of a mile off, I landed and went over to it, and discovered that I had passed through it just three hours before. This will show how winding the course of the river is in this part. At nights, when the lamp was lit on the upper deck for dinner, the table and deck overhead near the light was simply a mass of insects of every description: large moths beautifully marked, numberless extraordinary animals with gigantic feelers, earwigs and gnats. As a rule, I am glad to say, there was an absence of mosquitoes.

Thick wood continued on both sides with occasional openings, at which we saw numbers of natives of the Waboni tribe, who live mostly by hunting. They are dressed with a piece of skin round the loins, and armed with bows and arrows. The trees were full of monkeys of every description, from the smallest to the largest-sized baboons; they seemed somewhat curious about the vessel, but did not appear in the least to be scared. Several white-headed eagles with numberless crocodiles made up the only game to be seen, the grass plains at the back not being visible. Several large snags in the river showing above the water with the sweeping current made the navigation somewhat

difficult, more especially as I had to take all the angles at the different bends for survey, occasionally anchoring to ascertain the strength of current with the patent log. Not one of the natives shipped as crew ever having been afloat before gave me sufficient work to keep me on the alert every moment when under weigh. As we ascended, the bends in the river became wider and more sweeping. I observed groups of the castor-oil plant, almost choked with the extraordinary luxuriance of creepers and undergrowth.

At 10 A.M. on the 25th we entered the Gusha district, the Shambas or cultivated lands commencing on the left bank. The inhabitants of Gusha some thirty or forty years back were solely composed of runaway slaves. Now the population has increased to an enormous extent. Where formerly there were a few villages now there are small towns with populations varying from 600 to 1000. They live entirely on the proceeds of cultivation. The clearings in the forest are first made by firing all the bush and lighting a fire at the foot of the trunk of each tree, which is left to smoulder. After a few days it comes down with a crash and a shower of sparks, and lies where it falls; but the land around is tilled and sown mostly with Mahindi (Indian corn), which is the staple food, mtama, sem-sem, a small brown grain which is crushed for oil; cotton and tobacco are also grown. These dead trees, which are to be found through the whole cultivated district for a distance of 100 miles, give remarkable facilities for obtaining fuel for steaming. The dead wood is quite dry and burns admirably, in many instances not even requiring to be cut into lengths. I may add that from the mouth of the river to Bardera I never had to cut a single tree down for firewood.

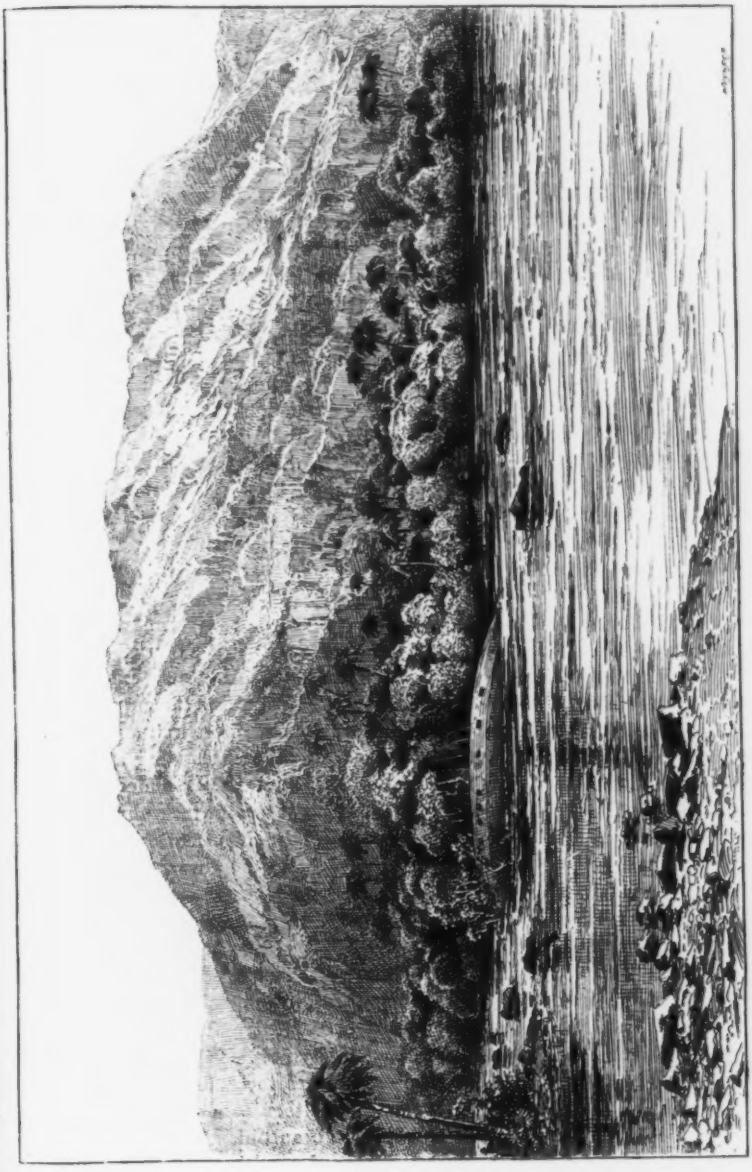
On arrival at a large island formed by the river forking I was perplexed as to which route to take, and which was the river proper. At length I took the north-east branch, which afterwards proved to be the right one, and arrived shortly at the village of Mataku. I was here told that the other arm or fork would join again some distance farther on, but that it was narrow and full of snags, with tortuous bends. The arm of river which I had taken was also most difficult to navigate. In many parts it was only 15 to 20 yards wide, with dense overhanging trees and branches standing out; thus for several hours we were constantly colliding with the trees, the swift current sweeping the vessel in amongst them risking the loss of the funnel and of the awning deck. I may here add that when it was requisite at any time to turn the vessel, she being 86 feet in length with 23 feet beam, the bow or stern had to be pushed into the jungle, leaving one end in the river which the current acted upon. It was an everyday incident for the vessel sometimes almost to disappear into dense masses of vegetation and creeper, which grow very thickly, and hanging from the lower branches makes

an almost impervious barrier. After four hours' steaming we again joined the other arm of the river, and it then opened out to a breadth of 120 yards. The first large village of Tula on the right bank was passed. The natives were out *en masse* to see the vessel pass, the women running along the banks uttering low peculiar cries, commencing on a very low note, and ascending to the highest each lady was capable of producing. Several more elderly females, having three and four small infants tied up in the mother's cloth and secured round their bodies, were careering along the banks, every now and then appearing at the openings in the high grass. How the young urchins escaped coming to grief I cannot conceive.

At length we arrived at Fuleile, the village where the Sultan of the Gusha district (Nasibu Mpondo, as he is called), resides. He is a tall, fine, powerful man, and at once came off to visit me, expressing his delight at seeing the steamer. He begged me not to go to Bardera, as he said the up-country Somalis were very bad, and would assuredly kill me. He said that he and all his people were the friends of the European. Throughout the whole Gusha district the Swahili language is spoken. From this village to Bilo there are numerous very large villages densely populated, and the banks on either side continuously are more or less cultivated, the cultivation extending in many instances several miles in from the banks. Very little wood is now seen, the country being a flat plain and excellently adapted for cultivation. Large groves of bananas and plantains were now frequent on either side, and as the *Kenia* moved along, hundreds of natives were to be seen at work in the Shambas. They nearly all dropped the jembe, a small flat iron hoe with handle with which they till the ground, and hastened to the banks to see the wonderful phenomenon in the shape of a steamer. Those villages which I passed on the way up (as I wished to get on as fast as possible for fear of the water falling) I called at on the way down, and made friends with all. At the village of Jelib I saw cotton growing, which was picked by girls, several twisting it on to improvised reels. A man was weaving with a wooden loom and shuttle, very primitive but ingenious, of native make. The man sat in a hole working a double treadle, and wove cloths of excellent texture, which were worn by the natives. On inquiry I learnt that not one from the village had ever even been to the coast or seen a white man.

It is estimated that the number of runaway slaves settled in this colony now numbers from 30,000 to 40,000 souls. They have expressed great delight at the advent of the Company, and have eagerly placed themselves under its protection. They hope now to find at Kismayu an outlet for the superabundance of grain they can raise in their very fertile district. There is a promising future for trade with these people, both in the export of grain and import of Manchester cottons.

Above Bilo, which is just 100 miles from the mouth, there was



RAPIDS ON THE UPPER JUB RIVER, WITH REMAINS OF VON DER DECKEN'S STEAMER.

dense impenetrable forest on either side. We arrived at the point where the Jub, in its downward course, forks. One branch runs off from the main river on the right bank to the south-west. I believe this may be the origin of the Sheri, which, as is well known, flows southward, and empties itself at Port Durnford, 80 miles down the coast midway between Lamu and Kismayu. Mooring the *Kenia* alongside the bank I explored this branch downwards in a small boat for 20 miles. It was from 3 to 3½ fathoms deep, with a current of 3½ knots. There was dense forest on either side. The stream was so narrow that branches of trees in some places projected nearly across; it was, in consequence, quite unnavigable for the *Kenia*. From the depth of water and large volume coming from the main river, I assume that it flows for some distance, and with this theory all the native accounts agree, as they said it went to the big water (the ocean). I shot two large crocodiles 14 and 16 feet in length; and from the depth of scale one must have been very old. I stopped at a small Waboni village where the people lived almost entirely by fishing. Fish of several kinds were plentiful in the river. One was as large as a salmon, but with an enormous head and teeth. Numbers of large turtles, from 30 to 40 lbs., were also caught in the Jub with a strong hook and line. I have often had turtle soup and wild duck for dinner when in the river.

On leaving the Sheri, the *Kenia* proceeded between wooded banks to the village of Mfudo. This is one of the last runaway slave stations. The clearings in the forest were still being carried out, and shambas were not yet formed. The forest on either side extends for about one mile, and then thick thorn woods for another three-quarters of a mile, when you emerge on the vast undulating grass plains so common to African scenery. I had some excellent shooting at Mfudo, the headman, Shongolo, being a capital hunter. I landed on the opposite bank several times, and, following a small track through the forest, came out on to the plain. I saw several magnificent ostriches, but never could get within 500 yards, there being no cover. Even after crawling in the hot sun I failed to get within reach, for their scent or sight was too keen; suddenly they would look round and dart away, just moving their wings and not stopping for several miles. Vast herds of buck, topè, kuguni, wildebeest, and smaller kinds of antelope enabled me to make several large bags, once including a rhinoceros.

On July 29th we came to the last settlement of the Gusha people called Shonde. There were only about thirty people in all, and they had lately arrived from one of the larger villages to establish a settlement and clear the forest for cultivation. On either side after this it was dense, primeval forest. The scenery was beautiful. There were thick green masses of foliage against the blue sky, with the brown, muddy river running silently on without a sound, except the stroke of the

stern wheel or the occasional splash of a crocodile disappearing off the bank into the water on the approach of the vessel.

The trees are mostly of the acacia kind, the African oak, with tamarinds and numbers of green thorn trees, etc. I was struck by the large masses of purple convolvulus intermixed with the thick network of creeper which cover most of the trees, forming one serried mass of foliage. Through a small opening, by a stream running off from the left bank, I made my way by canoe into a large lake having no outlet. In the black alluvial soil of the river I saw several sparkling grains of metal like gold-dust. I washed samples of it, and the grains of metal still appearing, I put some in a bottle for transmission to Mombasa, but have not yet heard what it might be. The probability is that it is not gold, but pyrites.

For several days now the dense forest continued without intermission. Numbers of hippopotami were about, and I secured several. Thick fogs in the mornings hung over the river until eight o'clock, when the heat of the sun dispelled them. The average heat in the river was 90° in the shade during the day, and 83° at nights. The monsoon at times blew very strongly, which made the nights much colder; but the temperature during the day never varied. The general depths of the river so far was from 1½ to 3 fathoms.

On August 2nd, after five days steaming through forest land without seeing any sign of human life, we suddenly emerged into the open, and arrived at the village of Kabobe. It is inhabited by a very mixed race, consisting of Somalis, Gallas, Swahilis, Wabonis, and Kabyles. The chief, Taiu, after a little time was very friendly, and the vessel created the greatest excitement, hundreds of natives standing on the bank alongside day and night. There were numerous shambas, and the people here lived partly on the produce of land and partly by hunting. Sweet potatoes, bananas, mahogo, cheroki, and koondi, a kind of bean, were to be obtained in profusion. I had two days' shooting on the left bank, and obtained several Kuru or water buck.

The river rose 18 inches in one night. From all the information on this point which I could gain it would appear that during the months of August and September the water rises suddenly, and in a week or ten days falls again with the same rapidity, this taking place several times during these months. Twice this sudden rise and fall came under my own observation. The natives told me it was caused by the rains far up country bringing the freshets down; but comparatively little rain fell over the expanse of country through which I passed. The chief here told me that the river is in flood part of July, August, September, and October; it falls rapidly in November, when it is possible to walk across the bed. In December and January the water is very low; in February it rises, and is partially in flood during March and April, when it falls again, rising in July.

On August 4th we left Kabobe. The features of the river altered somewhat, the reaches being wide and shallow. The vessel grounded on sand-flats, but came off again, the depth varying from ½ to 2 fathoms. We passed a high slate rocky bluff, 30 feet high, sheer to the river. After some little distance the woods disappeared, and the country opened on to the plain studded with mkono palms and mimosa thorn. High flat ranges of hills rose on the north-east. From Anole, in latitude 1° 59′ 52″ N., the banks entirely change, becoming hard and stony, with slate intermixed. A plateau 200 feet in height extended on either side for some distance with a peculiar sugar-loaf peak close to the right bank. The water was now very shoal, and the vessel grounded repeatedly. There were great numbers of hippopotami about, as many as fifteen and eighteen standing close together on a bank in the centre of the river. We passed three high rocky bluffs rising 150 feet high sheer from the river just before arriving at the large Somali village Mansur.

Here I was informed that the Sheik of Bardera had sent down to say that the European was to go back, and not to attempt to go up to Bardera, or he would be killed. He added that the only European, many years before, who had come to Bardera had been killed, and the same would happen to this one. I replied that I was going to Bardera, and wished to make friends with the sheik. The up-country Somalis have nothing to do with the coast tribes and Ogadens. From Mansur the same features prevailed.

Turning a bend we came in sight of Bardera on the evening of August 10th. The town is situated on a hill on the left bank adjoining the river. The whole of the bank was lined with Somalis, and evidently from their excited state, some trouble was brewing. The crew in terror begged me to turn back. I made the vessel fast to the right bank, opposite Bardera, the river here being 60 yards wide. I sent a Somali interpreter to speak with the sheik, but the men rushed down to the landing-place, brandishing their spears, and threatening to kill him if he landed; so I hailed him to return. Having camped the porters alongside the vessel on the right bank, I received news through some of the Barra Somalis (Somalis of the plain) that the sheik was sending a large force across some little distance up to attack the vessel that night. I withdrew the men on board, leaving the tents pitched and the fires burning, quietly pushing the vessel from the bank, anchoring in mid-stream. At 11 P.M. I saw large bodies of natives on the right bank moving about between the trees. Suddenly they dashed into the river, swimming off on both sides. Unfortunately, or let us say fortunately, my Maxim guns were useless, and could not be fired; but attributable entirely to circumstances beyond my control, and my crew were too frightened to make it safe to depend upon their rifles. When the Somalis were just clambering on board, I fired a sound signal which I had with

me, hoping that its novelty might intimidate their savage nature. These signals are fired from a socket fixed upright with a tube, and having used them a great deal on the coast in England, the thought occurred to me in Mombasa how well they might answer as a last resource with natives when used for the first time. I therefore carried several with me in my former expedition when in the Masai territory, but never had occasion to use one. On the present occasion the signal proved most effective. When it burst in mid-air with a loud explosion, lighting up the whole river with its shower of red stars, the water being black with heads, I had the satisfaction to see the natives all turn and make for the banks in terror. No further attack took place.

The next morning, knowing that some move was imperatively necessary, I landed suddenly amongst the Somalis, at Bardera, unarmed, with my interpreter. I pushed through the threatening crowd of natives to the sheik, expecting half a dozen cold spears through my back every moment, as they pressed round with their spears raised. I think the sheik was too astonished for words. I said *Aman* (peace), and told my interpreter to say I meant to do him no harm and wished to be friends. The chief at last asked me how I dared to come unarmed among them; that I was completely in his power, and that he could easily make an end of me. I said he might do so if he liked; that I cared nothing for him, but I knew I had done him no injury, and why should we not be friends. Had the Company wished to take his country I would have come with a large force, instead of which I came entirely alone. Was it to be *Aman* or not? After a few moments, apparently taken aback at what seemed my foolhardiness, he said there should be *Aman*, at least until he had consulted the chiefs. He bade me go on board and await the result. As you may guess I did wait with some anxiety, but at the end of five hours the sheik sent a present on board as a token that we were to be friends. He said he did not like white men, but he rather liked me personally. After some days we became great friends. I told him I wanted to go further up the river, to which he at first objected; but on my offering to take as many of his people on board as we could hold, or to leave some of my own, he eventually consented. He sent the second sheik with two other chiefs to accompany the *Kenia* up to the rapids, situated 25 miles above.

Bardera is an old town with remains of a wall running round it; the population is about 1200. The huts are large and clean, the inside being hung with skins and divided into two rooms. There is little or no cultivation around Bardera, and the people live principally on cattle and sheep, there being vast herds feeding on the banks. The great caravan route from the Boran country crosses the river at Bardera; by this are brought ivory and hides which find their way to Brava and the northern ports.

When navigation of the river is regularly established and this waterway is opened to commerce, the bulk of the trade now finding an outlet at the northern ports will be diverted to Kismayu. It must not be overlooked that the trade of the Somalis is not carried on by human porterage, but by camels and other baggage animals, so that with the port of Kismayu permanently open the trade of the interior should be attracted to the terminal point of navigation on the river. The large annual shipment of hides from the Somali ports points to their country being an extensive pastoral one. Considerable quantities of the best grey cottons, known here as "Americani," are imported. The inferior kinds of Manchester cloths which are bartered in the Hinterland of Mombasa are unsaleable amongst the Somalis.

Logh, another large Somali town, is five days' journey from Bardera. The road passes into the Barra, and does not follow the river on account of the very hilly character of the district, with dense thorn woods. The only other route into the Boran country crosses the river at Logh. The Ganana district is several days march above Logh.

With the second sheik and two other chiefs on board I left for the rapids, the water in the river falling rapidly. Past the village of Marda the river ran between a range of steep, rocky hills, 300 to 400 feet high.

Arrived at the rapids, where the bed of the river was a mass of rocks, I made the *Kenia* fast on the right bank, near a small sand beach. Baron Von der Decken's ill-fated vessel, the *Guelph*, which was wrecked twenty-seven years before, almost to the day, was now lying close-to, on her starboard side, the funnel still standing straight up, with two trees growing up alongside. I visited the *Guelph* several times, and found one side all gone, with two rocks through the bottom, which was silted up with sand and mud. The shell of the port side, with beams and davits, remained; cylinders and boilers were still in position. A large and a smaller island in the centre of the river divide it into three channels. The one off the right bank, taking a very sharp turn, is a mass of rocks; the centre channel being dry, and the other off the left bank the only possible one. But I consider it utterly impracticable for navigation, the depth varying from 6 inches to 3 feet. The current sweeps among the numerous rocks at the rate of 6 knots. I attempted to haul a small boat through, but had to give it up, she being nearly dashed in pieces. One of the Somali chiefs, a very intelligent man, told me that four hours march above the rapids the river falls over a ledge of rock; therefore if a vessel could be got beyond the rapids, through a great rise in the river, she would be stopped by these falls. I wished to have gone by land to see these falls, but the chief informed me there was no road, and it would take some time to cut through the thick thorn bush on the bank. The latitude of the rapids is 2° 34′ 45″ N. The distance

from the sea by the river to these rapids is 407 miles, and to Bardera 387 miles. In the whole of this distance the Jub receives no affluent.

Leaving the rapids to return to Bardera on August 16th, we grounded heavily several times on the shallow sand flats, the river having fallen several inches, and parts in the centre where the vessel had passed over on the way up being now dry. We took three days to get to Bardera, having several times to clear everything out of the vessel to get her off. Remaining only one day in Bardera for fear of being stopped by want of water, and leaving the sheik and his people on the most friendly terms, I started to make the descent of the river. For days the *Kenia* was on shore on different sand-banks, and the work of clearing her out of all stores, and transporting to the bank by one small boat in the strong current, was very heavy and hazardous. However I succeeded in getting her off, and, after running numerous risks from the strong current and very sharp bends at different points in the river, at length we arrived at Gobwen on September 20th, near the mouth of the river, after two months' absence. Here I was told that news had been received on the coast a month previous that the *Kenia* was broken up, and the European killed, the crew being made slaves of by the Somalis. The fact that part of the light casing of the *Kenia* had been broken off colliding with some of the trees and actually floated down the river 250 miles, when it was picked up and forwarded to the Superintendent at Kismayu as evidence of the destruction of the vessel, naturally caused some credence to be attached to the story prevalent on the coast.

The Somalis are a fine race, extremely proud, and would not on any account show the slightest astonishment at anything; no expression of wonder ever passed across the face even when I showed them the engines, the Maxim guns, and a revolver. Their dress is a white cloth, 7 yards in length, 2½ in width, of broad Americani or drill, which is wound round the body and the end thrown over the shoulder. The women of Bardera, in addition to the white cloth, have a Kanaki cloth of dark blue or black over the head, and wear white leggings from the knee to the foot over sandals, which does not enhance their personal appearance. The men are all armed with the long spear, small round rhinoceros-hide shield, and short stabbing knife. Nearly the whole of the Somalis I met are strict Mohammedans, and are most particular, especially in Bardera, to pray at sunrise and sunset. My position, on account of the fanatical Mohammedanism, was a somewhat perilous one, as I was looked upon as an infidel, and the sheik said that for this reason it would be unsafe to go about, as it would take some time before his people could become habituated to seeing a European in Bardera. The grasping nature of the Somalis is very observable; no matter what was given in the shape of a present they invariably wanted more.

The second sheik and two other chiefs whom I had on board for several days were most observant and anxious to know about everything, asking numberless questions. They eat a great deal of meat, but the favourite dish throughout Somali-land is coffee-beans stewed in ghee—a kind of rancid fat.

The climate is excellent; not a single case of fever occurred during my stay in the river. This I attribute to the dry heat and to the fact that the river does not overflow its banks, as the Tana does, creating vast malarial swamps. In that river the clouds of mosquitoes at night made life unbearable. In the Jub River it was an exception to find many mosquitoes, and most of the time a curtain could be dispensed with. The country is admirably adapted for cultivation and European enterprise, in the Gusha district, the ground being very fertile and the people glad and willing to receive Europeans and trade with them. I hope that as the river has now been ascended without bloodshed, the way will be open to further communication, and that peaceful trade—the great object of a chartered company—may soon follow. The *Kenia* remains in the river, and is ready for another ascent when the directors of the Imperial British East Africa Company consider it desirable.

After the reading of the paper the following discussion ensued :—

Captain WHARTON: When my old friend and shipmate Captain Dundas wrote to me from East Africa to say he was going up the Jub, I must say I thought there was a very great chance of never seeing him again. I had seen a little of the Somalis on the coast in 1877, and formed a very strong opinion that if the Somalis were determined he should not get up the river he would not do so, and as all previous experience had shown that that was their general line of action, one's mind could not help coming back to Von der Decken's ill-fated expedition. The preliminary difficulty at the bar I did know of, as I observed it when passing near the mouth of the river, but I did not try it, for it is about as nasty a bar as ever I saw, for getting over with a ship broadside on to a rolling sea is very difficult. Captain Dundas has opened up a new line into the country without bloodshed, and by a mixture of audacity and jolliness, which always goes down with the African, even though he be a Somali, not quite so amenable to laughter as other Africans, has added something to African exploration which I hope will be for the benefit of the British East Africa Company and England generally.

Mr. RAVENSTEIN said that Captain Dundas's survey of this important river agreed in the main with the survey made during Von der Decken's expedition. Captain Dundas was most certainly the second European who had reached Bardera, although several claims had been advanced to that honour. Mr. Henry C. Arcangelo, who read extracts from his diary before this Society in 1866 (*Proceedings*, x. 1866, p. 113), and published several papers in the *United Service Magazine*, claimed to have ascended the river in 1836, for a distance of 240 miles, but inquiries made by Captain Guillain at Gobwen clearly showed that that gentleman never got further than that place, and returned thence to Barawa. In 1853, a Captain J. H. Short told Mr. Macqueen that he had gone up the river for 210 miles, and that he saw snow-clad mountains far away to the westward. These mountains, however, had not been discovered since (*Journal*, R.G.S., 1860, p. 134). More recently, in 1875, an Egyptian expedition had been despatched to the east coast of Africa on the

proposition of General Gordon, with instruction to take possession of Mombasa with a view of establishing communications with Uganda. Colonel Chaillé Long, who had just published a very entertaining book on Egypt and the Sudan, was attached to that expedition, and claimed to have ascended the river for 150 miles in a steam-launch. More recently still, an Italian, Captain Ugo Ferrandi, had approached Bardera by land, but had not actually entered that town. But whatever degree of credit might be given to these various claimants, there could be no doubt that for our actual knowledge of this river, excepting of course its mouths, we were indebted to Captain Dundas and the expedition led by Baron von der Decken. Captain Dundas had not been able to visit Logh or Ganana, which latter, we now learnt, lay on a different arm of the Jub, but he had thrown some light upon another interesting question. It had been asserted that the Jub, after the rains, discharged branches, which were lost in the sands, formed backwaters, or even reached the sea. Captain Ferrandi believed that he had crossed such a branch (dry at the time) which he was told entered the sea to the east of the present mouth of the Jub. Natives had spoken of similar branches which filled a number of lakes in the Wama country, apparently a most interesting region at the back of Kismayu, which it was to be hoped would be fully explored at an early date by an official of the B.E.A. Company. Captain Dundas had not observed any of these lower "outlets," but he had actually navigated a river flowing *out* of the Jub in the direction of Port Durnford. It was not likely that this outlet actually reached that port. At all events, here was an interesting subject to be elucidated by future explorers.

The PRESIDENT: We have listened to a very excellent paper from Captain Dundas—admirably illustrated. I observed that you received with particular pleasure some accounts he gave of his personal experiences, and I am not surprised, for I hardly ever heard a better illustration of the happy phrase of one of our poets: "The calm, open-eyed rashness of Englishmen born." You will, I think, give your most cordial thanks to Captain Dundas, and include in them also the Hydrographer to the Admiralty, who speaks with so great an authority on every subject upon which he addresses us, as well as Mr. Ravenstein, whom we know as so accomplished a geographer.

Commander DUNDAS'S MAP.—The general map of the River Jub, and the chart of its mouth, have been reduced from Commander Dundas's own maps. The sketch of the coast between Kismayu and the mouth of the Jub is intended to show the line of the tramway which it is proposed to construct from Kismayu to Gobwen.

RECENT EXPLORATIONS IN THE SOUTH-EASTERN CONGO BASIN.*

By E. G. RAVENSTEIN.

THE vast territory of 250,000 square miles forming the whole of the south-eastern portion of the Congo State, which was "conceded" in 1891 to the "Katanga Company," has recently been explored by several Belgian expeditions, fragmentary reports of which have appeared in *Le*

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* Map, p. 288.

Mouvement Géographique, accompanied by skeleton maps.* We have combined the information supplied by our contemporary with the results of previous explorers, including Commander Cameron, who was the first to drive a trunk-line through Urua; Reichard (1884), the first educated white man who visited Msidi's residence at Bunkeya; Messrs. Capello and Ivens (1884); Mr. F. S. Arnot (1886–8), who founded a missionary station, still occupied, near Bunkeya, and Mr. Alfred Sharpe (1890).† The map produced must be looked upon as quite provisional, for discrepancies in the statements of these explorers can only be cleared up when the full reports of their work shall have been published.

The first of the expeditions with which we propose to deal is that of Lieutenant Paul Le Marinel, who left Lusambo, on the Sankuru, on December 23rd, 1890. He first of all followed the Lubi for about 100 miles. He found it to be a rapid river, about 80 yards wide at its mouth, and not navigable. The country has a dense population, for up till now it has been spared the visitations of slave-raiding Arabs; the inhabitants own cattle, sheep, goats, pigs and poultry, and cultivate bananas, manioc, ground-nuts and sweet potatoes. They dress their hair in the most grotesque fashion, and paint their faces and bodies. Their only arms are long spears. At Chikunga (6° 4′ S., 2560 feet) the explorer left the Lubi and entered Kanioko, which extends thence to the Lubilash. The Balungu, who inhabit this country, have made some advance in civilisation; their agricultural products are of the most varied character, and they live in comparative comfort.

The Lubilash, where crossed (7° 58′ S.), was nearly 100 yards wide, about 10 feet deep, and of sluggish current. The country of the Kalundwe on its eastern side is fertile, densely peopled, and traversed by broad, carefully-kept roads. The Babondo, further south, live in stockaded villages, at constant war with each other. Going still further south M. Le Marinel passed close to the swamp which gives birth to the Lomami, and ultimately reached a miniature lake region in Usamba (Samba), described by him as a beautiful country, with fine trees, short and luxuriant grass, huge ant-hills, and an abundance of game—including elephants, buffaloes, antelopes, zebras, lions and leopards.

Proceeding eastward towards Bunkeya, the explorer crossed the Lubudi and then the Lualaba (9° 54′ S., 2620 feet), beyond which he came through the country of the Bena Kalambo, who inhabit small stockaded villages, and in time of danger retire to caverns in the Kanke mountains. Easterly winds prevail in these mountains, and the cold

* More especially the numbers for April 3rd, November 13th, and December 14th, 1892.

† The first "white" man who visited Urua appears to have been J. B. Ferreira, of Bihe (1871).

at night is occasionally very sensible. Clay-slate and various schists are the prevailing rocks, iron-ore abounds, and a wild vine grows bearing blue berries. On April 18th, Lieutenant Le Marinel arrived at Msidi's capital, which at that time had a population of six to nine thousand souls. Having established his companion Legat in a station built to the east of the Lufira, the leader of the expedition returned by a more northerly route to Lusambo, where he arrived on Aug. 11th, together with Mr. Swan, of Mr. Arnot's mission, who had joined his caravan.

Of the three expeditions despatched in 1891 by the Katanga Company, that led by M. A. Delcommune was the first to reach Bunkeya, Msidi's capital. This expedition left the residence of the "Arab" slave-hunter Gonga Lutete, on May 18th, 1891. Its members included Lieutenant Hakansson, Dr. P. Briart, and M. Diederich, a mining engineer. It successively passed through Lupungu's stockade, Moina Goio, and quite a number of Luba "street-villages," one of which had a length of 5 miles. The Lomami was crossed in lat. 7° 31′, and on July 19th the expedition arrived at Kilemba Museya's, who is both son and nephew of Cameron's Kasongo Kalombo. After a visit to Lake Moryo, to the north, and to the lake region of Usamba, far to the south, M. Delcommune started for Lake Kasali, which he reached on August 27th. In skirting that lake he passed through Kikonja, where Lieutenant Hakansson and twelve men of the rear-guard were killed by the Baluba. The Lualaba was crossed near the Lovoi confluence, where its volume was 890 cubic feet a second, thus proving it to be inferior to the Luvwo, Eastern Lualaba or Luapula, which in the same month of the following year was found to discharge 1830 cubic feet a second at its outflow from the Mweru.

M. Delcommune, in his subsequent journey to Bunkeya, made his way partly along the valley of the Lufira, partly over the Kibala mountains, and reached Msidi's capital on October 6th, 1891. Msidi, by that time, had become a "lion grown old." He was very desirous that his visitor should assist him in his conflicts with the revolted Basanga; but M. Delcommune very wisely refrained, and prosecuted, instead, the exploratory work with which he had been charged. Having moved to the station on the Lufoi founded by his predecessor, he started in November for the copper mines of Katanga and Ntenke. A very difficult march took him thence to Musima on the upper Lualaba. A fearful famine reigned in the land; the country was absolutely deserted, and his men had to live on mushrooms and wild fruit. Many of them died by the road. At Musima he built boats for a descent of the river—a tedious task, as trees of suitable size were rare in that grass-land. A start was made at length on February 25th, 1892. The river was about 60 yards wide with a volume of only 200 cubic feet a second. It was full of rocks and rapids, which necessitated frequent

portages, and ultimately, after having traversed a stretch of smooth water, M. Delcommune found himself stopped by the Nzilo Falls, where the river pours over a wall of rock down into a narrow gorge 1000 feet deep. The leader of the expedition very bravely attempted to overcome this obstacle by dragging his boats overland; but as it took him a month to advance 10 miles, and as an excursion to the Lufupa clearly demonstrated the impracticable nature of the country, he reluctantly gave up his task, and returned to Bunkeya, where he arrived on June 8th, 1892. Finally he turned north-eastward, and joined Captain Joubert at Mrumbi (Baudouinville) on Lake Tanganyika on August 20th. When last heard of M. Delcommune was with Captain Jacques at Albertville, and he intended, notwithstanding the disturbed state of the country, to effect an exploration of the Lukuga River.

The second expedition was led by Captain W. G. Stairs, who was accompanied by Lieutenant Bodson, the Marquis de Bonchamps, and Dr. Moloney. As an account of this expedition will probably shortly be furnished to the Society, we confine ourselves on the present occasion to a few notes. Captain Stairs left Bagamoyo on July 4th, 1891, for Karema, on Lake Tanganyika. He thence crossed the lake to Mrumbi (Captain Joubert's station), and started from that place on October 31st for Bunkeya, following, in the main, the routes first traversed by his predecessors Reichard and Sharpe. On November 19th he crossed the Eastern Lualaba, or Luvwa ("river"), at Ngwena, a place two days' journey below Mpweto's. The river there is 300 yards broad, and quite unnavigable owing to its inconsiderable depth (not exceeding one foot in some places), the rocks which strew its bed, and a number of rapids. Even in the rainy season the river does not rise more than 30 inches. Its wooded islands are occupied by villages.

Captain Stairs arrived at Bunkeya on December 14th. Six days afterwards his companion, Lieutenant Bodson, shot Msidi in self-defence, but was himself shot by one of the attendant chiefs. For nine months past Msidi's ephemeral "Empire" had been a prey to civil war, provoked by the chief's rapacity and cruelty. Many villages had been destroyed, and entire districts abandoned by their inhabitants. The fields had remained untilled, and thousands fell victims to famine. Captain Stairs, immediately after Msidi's death, summoned the chiefs, and they willingly accepted the flag of the Congo State. Mkande Wantu was appointed chief of Bunkeya, but the "Empire" of the Garenganze was a thing of the past; it had not endured even for a single generation! On January 30th, 1892, Captain Bia arrived at Bunkeya, and Captain Stairs, whose health was failing, was thus able to leave for the coast, but he died at Chinde, on June 8th, on the eve of his return to Europe.

Captain Bia, the leader of the third expedition, had associated with him Lieutenant Franqui, Lieutenant Derscheid, Dr. Cornet, and Dr. Amerlinck. The *Princesse Clementine* carried the leader and his

companions from Lusambo to Pania Matumba, Kachich's residence, on the Sankuru, which, above the falls discovered by Dr. Wolf, is known as Lubilash. They then proceeded by land, following the river for about 100 miles, as far as the confluence of the Luembe. The Lubilash is not likely to prove a very serviceable waterway, for it is shallow and fordable throughout. Up to where it receives the Kashimbi it follows a winding course through a broad valley bounded by wooded hills; next follows a wooded savannah, and higher up still the grass-land, with which travellers in Africa are familiar, where trees are found only in the ravines and round the villages. In the north the country had been laid waste by the Arab slave-hunters, but further south the Baluba dwelt in large villages, and cultivated manioc, maize, and bananas. The villages were not stockaded, the natives had but few guns, and were friendly.

The Luembe (Luwembe), which the expedition followed for twelve days as far as Moigonka (3420 feet), takes its course through a fertile valley. It is of considerable depth, in places, but its course is obstructed by rapids. All the villages beyond Moina Mpafu's (where Captain Bia established a "garrison" of three men) are defended by stockades, and this defence is adopted quite as much against the Arabs and Kasongo of Urua, as against neighbours who ought to be friends. A pastoral plateau (4050 feet), abounding in numerous-wooded ravines and stockaded villages, separates the Luembe from the Lomami (3480 feet), which was crossed in boats on December 21st. A low and swampy forest (3720 feet) separates the basins of the Lomami and Lovoi, a tributary of the Western Lualaba. It was at Kahamai, just before reaching the Lovoi, that Captain Bia crossed Cameron's track. The country to the eastward, as far as the Lualaba, is described as a wooded savannah; the villages are stockaded and hidden among trees. The natives are armed with bows, poisoned arrows and javelins, and are in the habit of waylaying caravans. Progress was rendered difficult owing to heavy rains, which flooded the whole of the country.

On January 2nd, 1892, Captain Bia reached Lake Kabele (3740 feet), a backwater of the Lualaba, with which it communicates by four channels which alternately fill and drain it. It is about 8 miles across, and fringed with a papyrus swamp. The Lualaba was reached at Mushimuna (January 19th), but Captain Bia crossed it higher up at Kisambo, where it is about 500 yards wide, with a feeble current and quite navigable up to the Bundwe Falls.* Having crossed the Lualaba, Captain Bia went through grass-land to Kibanda (Chivanda) on the Fungwe, and visited the hot spring in the neighbourhood. He then

* Unless there is some gross mistake either in Lieutenant Le Marinel's or Lieutenant Derscheid's latitudes, the latter of whom places Kizinga on Lake Kabele in lat. 8° 52′ S., whilst Lieutenant Le Marinel tells us that he crossed the river in lat. 9° 12′ S, both expeditions must have crossed the Lualaba in the same locality.

crossed over lofty hills, where bamboo forests occupy an extensive area, and ultimately came out upon the plain of Manika, near the Lufira. On January, 1892, he was at Bunkeya.

Dr. Cornet states that the whole of the region traversed, with the exception presently to be stated, is occupied by horizontally-bedded crystalline schists and primary rocks (Devonian, Carboniferous and Permian). Between the Lovoi and the Manika plain the strata are tilted up, and concealed by a superficial deposit of recent age. Eruptive rocks of great variety abound in this disturbed region, and argentiferous ore was discovered.

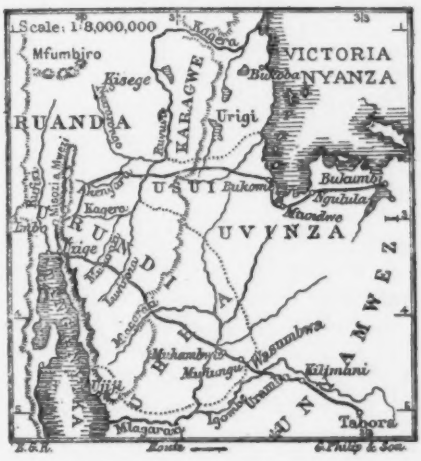
In June last Captain Bia appears to have started for Lake Bangweolo.

DR. BAUMANN BETWEEN VICTORIA NYANZA AND TANGANYIKA.

Dr. O. Baumann has accomplished a journey which throws considerable light upon the country between lakes Victoria and Tanganyika. Leaving Bukombi, on Smith's Sound, in the beginning of August, he travelled through Uzinja to the Emin Pasha Gulf. He left the Victoria Nyanza at Bukome (2° 48′ S.) where Mr. Stokes has a station, and travelled westward through an uninhabited country until he reached Eastern Usui, whose chief, Kasasura, willingly supplied him with provisions, although declining to receive the traveller. Mr. Stokes and several Arabs have stores at the chief's capital. The ivory trade is important, and there is no trade in slaves. The country is intersected by numerous cliff-bound valleys, separated by broad, rolling plateaus, fairly well cultivated. Sorghum, manioc, sweet potatoes, and bananas are grown. The drainage is towards the Urigi Lake. Western Usui, or Uyagoma, is a stony land without perennial rivulets, and water is procured from wells. The inhabitants are Wazinja much mixed with Warundi, and the language of the latter is spoken. The chiefs are Wahuma. On August 28th Dr. Baumann crossed Mr. Stanley's route, and on the following day arrived at the poor village of Yarigimba, the chief of the country. Four days afterwards he reached the Kagera or Ruvuvu River, which separates Usui from Urundi; it was crossed in boats. The Warundi received their visitor with much rejoicing, for they conceived him to be a descendant of their king, Mwezi, who had been killed in battle about a generation ago,* and had gone to the moon ("Mwezi"). Northern Urundi is a country of grass-clad mountains, on the slopes of which are built the villages hidden among groves of bananas and of trees with shining leaves, which supply bark

* Mwezi ("Moon") is mentioned by Burton (*Journal*, R.G.S., 1859, p. 278).

for making cloth. The narrow valleys are full of running water, often choked with papyrus swamps. The population is dense. Provisions (pulse, bananas, and cattle) are plentiful, and there are neither beggars nor thieves. The pastoral Watusi (Wahimi) occupy a great part of the country, and domineer over the Warundi. There is also a pariah tribe, the Watwa, who hunt and make earthenware. After a journey of four days through this country, Dr. Baumann, on September 11th, crossed the Akenyaru, also called Nyanza ya Akenyaru, although not a lake, as supposed by Mr. Stanley, but a navigable river, which broadens out occasionally into papyrus swamps. The Nyavarongo (Mworongo of Mr. Stanley) is a tributary of it. The Akenyaru separates Urundi from Ruanda. The character of the country remains the same, but the villages are cleaner and the agricultural products more varied. The people are kinsmen of the Warundi, and, like them, are under the Government of Watusi. Dr. Baumann was invited to pay his respects to King Kigere, who resides at Kizege, a few days to the south-east of the Mfumbiro, but he declined to do so. After four days' march in a westerly direction he once more crossed the Akenyaru, about one day's journey from its source, and re-entered Urundi. The mountains grew loftier, and numerous rivulets take their course through steep valleys in the direction of the Ruvuvu or Kagera. The Warundi were as enthusiastic as before, and their worship extended even to the white donkey of the man whom they supposed had returned from the moon. The Watusi, however, proved hostile, but their attacks on this and subsequent occasions were easily beaten back. Following a wooded mountain range, known as Misozi a Mwezi, or "Mountains of the Moon," which forms the watershed between the Nile and the Rufizi, Dr. Baumann, on September 19th, arrived at the source of the Kagera, which he is inclined to look upon as the true source of the Nile. The Warundi hold this locality sacred. In an ancient wood close by they used to celebrate the funeral rites of the Mwezi, whom they buried upon the summit of the Ganzo Kulu, which rises above the "Mountains of the Moon."



Dr. Baumann rested here one day, and then followed the dividing

range to the south, crossing numerous spurs. On the following day he crossed the watershed at an elevation of 10,000 feet, and reached the fertile district of Imbo, where he saw the broad plain of the Rufizi lying beneath him. Villages were numerous. The oil-palm and grey parrots were again seen, and many of the natives were dressed in cotton, those of northern Urundi and Ruanda having contented themselves with skins and bark-cloth. On September 25th, the traveller reached one of the stations of Rumaliza, in Uzige, at the northern end of Tanganyika. The Warundi in this district, fish, till the soil, and export palm-oil, but the Arabs principally deal in slaves.

Dr. Baumann then travelled in a south-easterly direction to Tabora, where he arrived on November 7th. Having climbed the steep mountains which shut in the lake on the east, he came upon a fine pastoral region, sloping to the eastward, and occupied by warlike Watusi. Here he crossed the Muvarazi and the Luviroza, tributaries of the Ruvuvu and consequently the most southerly head-streams of the Nile basin. Stony ranges of mountains form the watershed between the Ruvuvu and the Mlagarazi. The last village of the Warundi, built on the branches of trees, stands on the latter. Uhha, which lies beyond, has open forests of great extent in which grow acacias and a tree resembling our beech. The inhabitants are kinsmen of the Warundi. They are governed by petty chiefs and live in small villages. All their cattle were stolen a few years ago by the Masai. Crossing the Mlagarazi once more and passing through Muhambwa and Mulunga, both districts of Uhha, Dr. Baumann arrived in Kirambo, which is inhabited by Wasumbwa, a division of the Wanyamwezi. He then crossed the Igombe River, passed through Urambo, now ruled over by Tugamoto, a son of the famous Mirambo, visited Mr. and Mrs. Shaw at Kilimani Urambo, and ultimately reached Tabora. During the whole of this expedition Dr. Baumann only lost five men, one of whom was killed by the Watusi. On the other hand there were "numerous" births among the wives of the elephant hunters who accompanied him.

THE PERMANENCE OF OCEAN BASINS.

By HUGH ROBERT MILL, D.Sc., F.R.S.E.

An interesting discussion has recently taken place in the pages of *Natural Science* upon the question of the relative permanence of oceanic and continental areas. Dr. A. Russel Wallace comments on the remarkable convergence of independent lines of research which led Professor Dana, Mr. Darwin, Sir Archibald Geikie, Dr. John Murray, the Rev. O. Fisher, and himself to the same conclusion, that continents and oceans have not changed places in geological times. He adduces

three new arguments in favour of these views:—(1) The enormous disproportion between the mean height of the land and the mean depth of the ocean, which would render it very difficult for new land to reach the surface till long after the total submergence of the sinking continent; (2) the wonderful uniformity of level over by far the greater part of the ocean floor, which indicates that it is not subject to the same disturbing agencies which throughout all geological time have been creating irregularities in the land surface—irregularities which would be far greater than they are were they not continually counteracted by the lowering and equalising effects of subaerial denudation; (3) the remarkable parallelism and completeness of the series of geological formations in all the best-known continents and larger continental islands, indicating that none of them has risen from the ocean floor during any era of known geological history—a conclusion enforced by the absence from any of them of that general deposit of oceanic ooze at some definite horizon, which would be at once the result and proof of any such tremendous episode in their past history.

Mr. Jukes-Browne combats the theory of the permanence of original oceanic and continental areas by pointing out that, as a matter of fact, deposits which must have been formed in very deep water have been detected in elevated land. He denies the force of the second argument quoted above on account of our comparative ignorance of the details of sub-oceanic geography, and because long-continued sedimentation must have tended to reduce the irregularities of the ocean floor, which would in any case be less than those of the continents, and, finally, because Mr. Fisher's theory of the sub-oceanic outpouring of lava might account for the uniformity of the ocean-bed. Mr. Jukes-Browne also shows how it is possible that the volume of the ocean was formerly very much less than it is now, and that in consequence of the release of water from chemical union with hot rock-material by volcanic explosions the volume has been steadily increasing. Hence, in palæozoic times, he argues that the land area may actually have been in excess of the water area, and the continental plateaux might have been much less elevated above the ocean floor than they are now—that, in fact, the elevations and depressions might not have been of the character of continent and ocean-basin at all.

Mr. Jukes-Browne's remark as to long-continued sedimentation obliterating the irregularities of the ocean floor requires proof. Dr. Murray has shown that the shallower the sea is the more rapidly does sedimentation far from land proceed, sedimentation tending to exaggerate and not to obliterate, initial differences of level.

Dr. W. T. Blanford, whose name had been mentioned in the articles as an opponent of the theory of the permanence of oceans and continents, explained that he objected to strong statements on either side, and urged great caution in forming opinions from such incomplete data as we

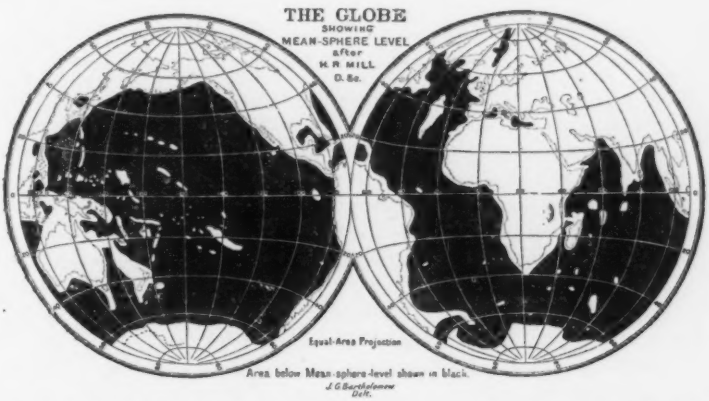
possess. He objected, as did Mr. Jukes-Browne, to assuming that no part of the sea-bed at a depth exceeding 1000 fathoms has ever been dry land; but Dr. Wallace explained that he took the 1000-fathom line as only an approximate boundary, and even in the first edition of 'Island Life' admitted certain exceptions. Hence his advance to 1500 or even 2000 fathoms in some cases did not affect the consistency of his views.

Professor James Geikie in his address to Section E of the British Association last year (*Proceedings* for 1892, p. 638), touched upon the interchange of elevation on the continental margin, and Dr. Blanford quotes his statement as one fairly representative of modern views on the subject. He says, "The continental plateau and the oceanic hollows have never changed places, although from time to time portions of the latter have been ridged up and added to the margins of the former, while ever and anon marginal portions of the plateau have sunk down to very considerable depths." In a paper on the "Evolution of Climate," published in the *Scottish Geographical Magazine*, vol. 6 (1890), p. 57, Professor Geikie gives a series of maps showing the approximate distribution of land and water at different geological periods, a re-statement with new data of Dana's earlier work. He understands the evolution of continents to be a transition from insular groups of land to a solid continental form, the island groups appearing upon the gradually emerging continental plateau. The diversity in opinion of students of this department of physical geography seems to be due rather to individual differences of confidence in drawing conclusions, than to any serious conflict of belief as to the bearing of ascertained facts.

The actual dividing line to be assumed between the oceanic and continental areas is obviously to a large extent arbitrary. The great ocean basins are comparatively flat-floored, the continental areas bounded by the 100-fathom line are, in a general way, roof-shaped, partly flat, partly composed of steep irregular slopes. Between these two great and definite regions there is everywhere a wall or zone of transition equally definite, forming a relatively abrupt descent. Along the slope of the entire development of this zone the difference of vertical height for a given horizontal displacement at right angles to the contour lines is greater than in any other part of the Earth, a few mountain ranges excepted. The line separating the two areas must lie somewhere on this slope. The 2000-fathom line lies near the bottom of the slope close to the ocean floor, the 1000-fathom line lies nearer the top than the middle of the transition zone.

Calculating from Dr. Murray's data, I showed in 1890 (*Proceedings*, Roy. Soc. Edin., vol. 17 (1890), p. 185), that the contour line of 1700 fathoms divided the surface of the Earth almost exactly into two equal parts, one a nearly continuous area of elevation, the other an equally continuous area of depression. This line I termed mean-sphere level, because it had the remarkable property of repre-

senting the intersection of a geoidal shell, the depression of the crust below which was equal in volume to the protuberance of the continents above it. The exact position of the line of mean-sphere level it is, of course, impossible to determine until the volumes of oceans and continents below and above sea-level have been accurately ascertained, and until sea-level is itself corrected for gravitational distortion, but the position cannot be very far removed from that assigned to it. The accompanying sketch-map on Lambert's equal-area projection serves to show graphically the two great areas of elevation and depression separated by the line of mean-sphere level. The area of depression may be termed the abysmal area, a name which Dr. Murray originally applied to the region lying at a depth greater than 1000 fathoms; the elevated half includes the dry land or continental area proper, and the transitional area or flanks of the continental plateau, at present covered with water. If any compressive stress were limited to one-half of the



area of the Earth's surface while the crust was plastic and undistorted, the surface being everywhere at mean-sphere level, a mass would be elevated over the free half to such a height as would, by its weight, balance the force of the pressure causing the depression, and if the density of the crust were uniform the depressed and elevated volumes would be the same. It seems probable that the series of changes which have evolved continents and oceanic hollows may be related to the line of mean-sphere level, the position of which corresponds with that which Dr. Wallace has been led to adopt as his boundary between oceanic and continental areas. By the adoption of this physical constant some of the objections to the theory of permanence are overcome, especially that which charges those to whom the evidence seems more complete than it does to others with a change of ground when they slightly modify an approximate and largely arbitrary limit.

The main fact, conceded by all who have studied the subject, is, that there is such a thing as the evolution of continents, the heights and hollows of the Earth's crust having become greater with the lapse of time. And all, also, concede that the present ocean basins represent regions where subsidence has predominated over elevation, while the continental area is that in which elevation has been more active than depression. Thus the actual level of the sea is an accident depending on the volume of its water and the inequalities of the crust, equal variations in which, on the hypothesis of constant volume in the ocean, may have led to very different emergence or submergence of the border areas according to the angle of the slope. At present the coast-line lies nearly mid-way on the flattest expanse of the continental margin, so that a given increase or decrease in the volume of the ocean would cover or lay bare the largest possible area of land.

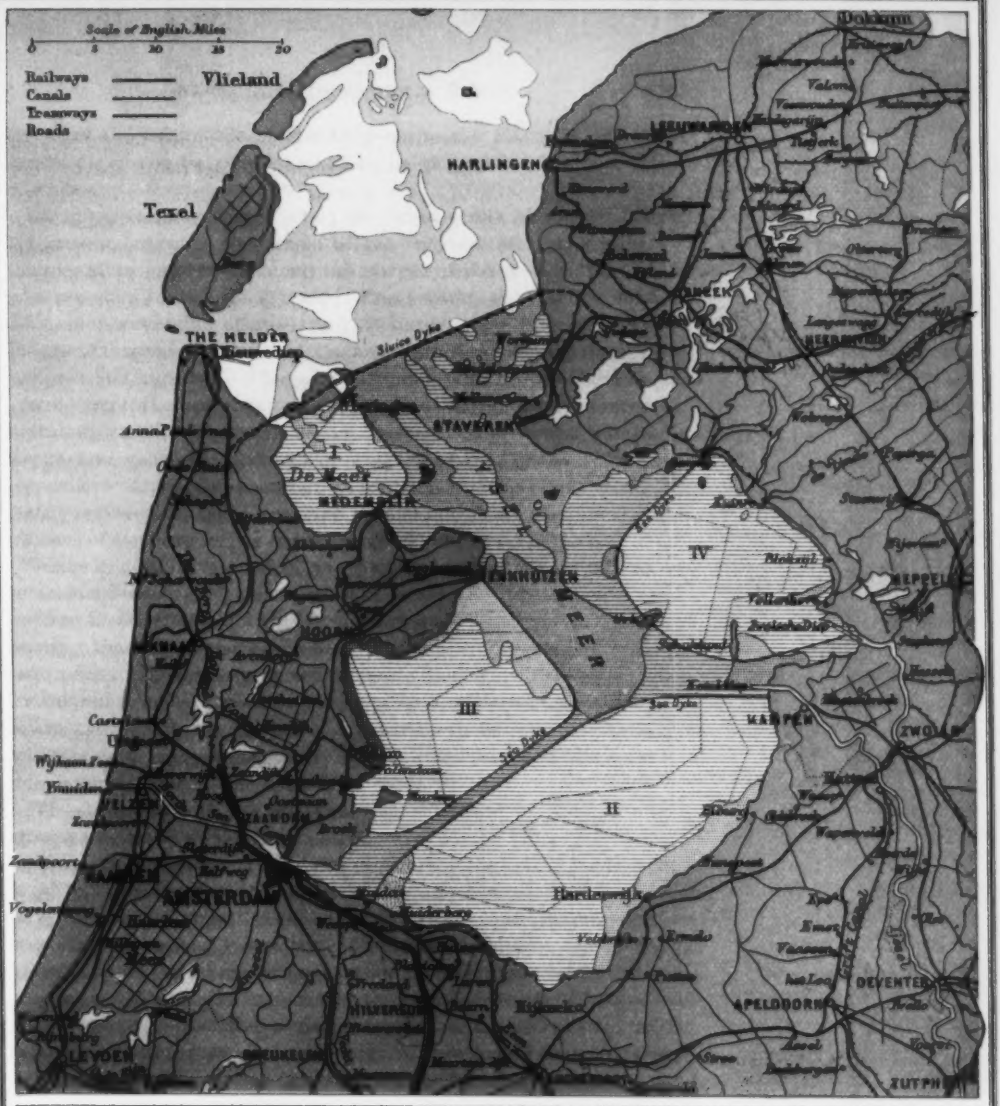
THE RECLAMATION OF THE ZUIDERZEE.

By Professor P. H. SCHOUTE, of Groningen.

THE question of the reclamation of land now covered by the Zuiderzee is no new one, but it is only recently that a thoroughly practicable scheme has been matured for the accomplishment of this great engineering feat. In 1886 a Committee was appointed to consider and report upon the question under the chairmanship of Mr. A. Buma, who had frequently urged this matter upon the attention of the Government. The result of the deliberations of this Committee has been published in the form of eight memoirs, in which the whole question is thoroughly discussed in all its bearings. The first memoir deals with general principles, discussing the best position and direction for the main dyke which shall shut off communication with the sea, and sketching a general plan of the engineering works to be effected. The commercial and strategical aspects of the proposed changes are also fully considered. The three succeeding memoirs are more technical in their treatment of the engineering problems. The means of protection against floods and the maintenance of navigable channels after the seclusion of the sea are entered into in some detail. In the fifth the best form of construction for the main dyke, with its sluices and other works, is minutely discussed, and the whole question of land reclamation by different methods is gone into. The sixth memoir is confined to a delineation of the present condition of the Zuiderzee, its depth, salinity, and the volume and velocity of the rivers which enter it. The seventh memoir has to do with the geological aspects of the scheme, discussing the nature of the sea-bed; and in the last the new plans are compared with former proposals for the same purpose.

As the subject is one of considerable geographical importance, on

PROPOSED RECLAMATION OF ZUIDER ZEE



EXPLANATION

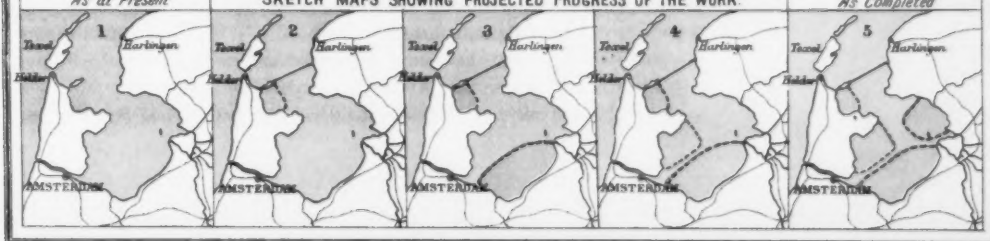
Present Land Surface — Areas to be reclaimed

The Sandbanks to the north are coloured a light blue tint.

Character of Land at present submerged: *Turf* — *Fertile Clay* — *Sand*

Limits of projected Polders

SKETCH MAPS SHOWING PROJECTED PROGRESS OF THE WORK.



Published by the Royal Geographical Society.

J. G. Bartholomew

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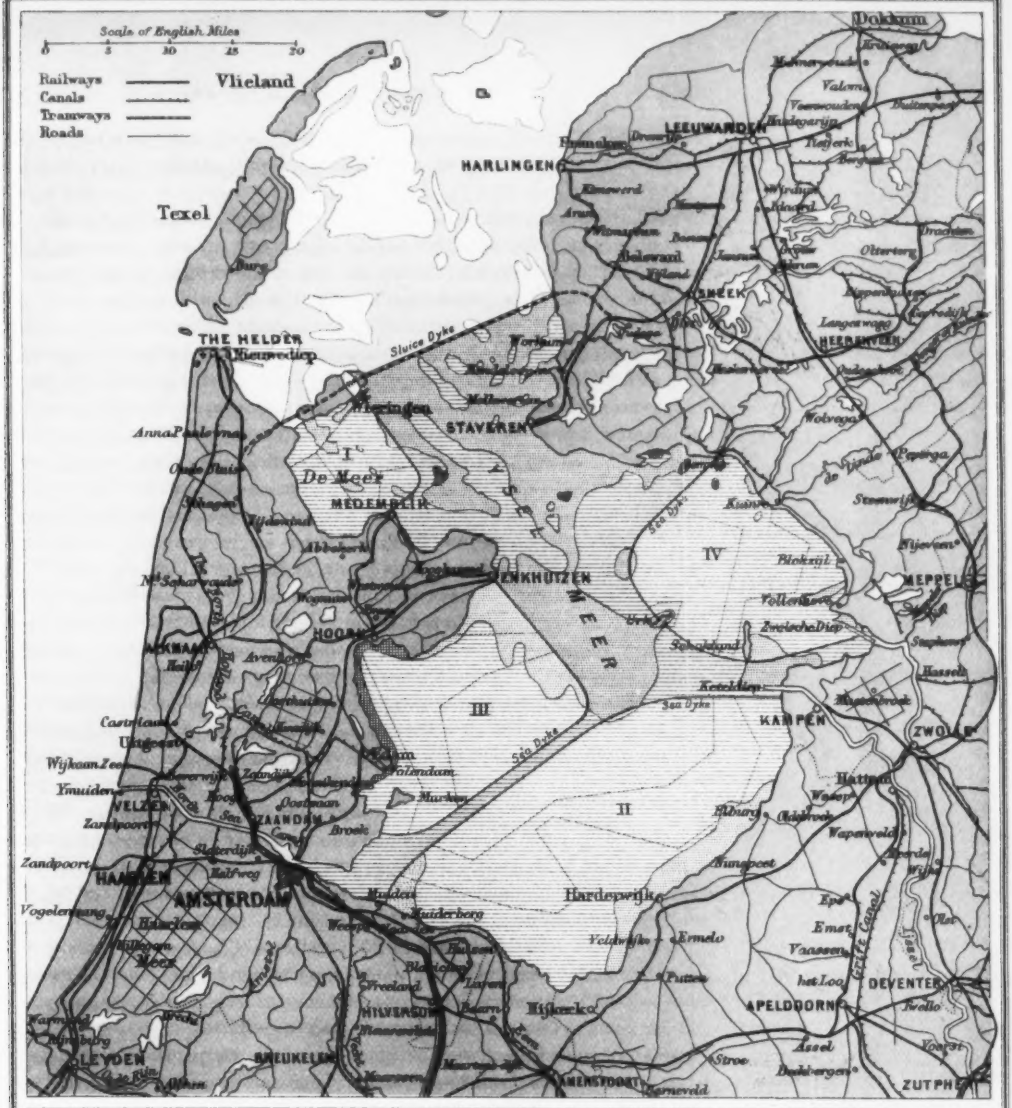

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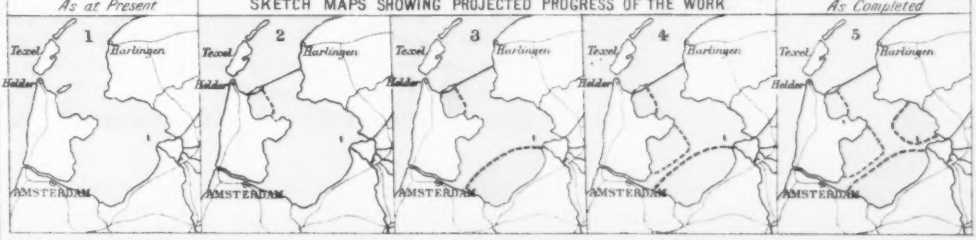

Published by the Royal Geographical Society.

account of the magnitude of the proposed works, I shall endeavour to summarise the leading facts embodied in the voluminous report just referred to.

The proposal is not merely to run a dam across the mouth of the Zuiderzee and reclaim the whole of the enclosed area, but rather to reclaim certain large tracts along the margin of the enclosed part of the sea, leaving in the centre a tract of fresh water, the Ysel Lake, from which wide navigable channels will radiate to the important towns. The plan of reclaiming part of the area without secluding the sea was examined and rejected. The general plan of the proposed works may be seen from the accompanying map, and the proposed process of gradual reclamation is shown in the series of small maps beneath it. The general geological features of the sea-bed are shown on the larger map, where it will be observed that the fertile clay regions of the present sea-bed are marked out for reclamation, while the uncultivable stretches of sand are left as the bottom of the future Ysel Lake.

While the main interest of the proposed works is concentrated on the reclamation of the sea-bed within the great dyke, the plans contemplate the linking together of the islands of Texel and Vlieland, and doubling the area of the new island thus formed by reclaiming on the eastern side. It is also proposed to unite the West Frisian islands—Terschelling, Ameland, Schiermonnikoog, and others—to each other and reclaim the shallow sea inlets which separate them from the Friesland and Groningen shore, thus greatly reducing the length of the coast-line and greatly increasing the area of the country.

The main dyke is to run from the mainland of North Holland, through the island of Wieringen on the west to the village of Piaam in Friesland on the east. This dyke (including the island) will have a length of 18 miles, and it is by no means an unimportant matter that the protection of these 18 miles will relieve from the necessity of protection the whole 165 miles of Zuiderzee coast-line, which has at present to be watched and strengthened. A very important function of the great secluding dyke is to reduce the range of the rise of water with storms. No corresponding serious increase in the storm-level of the water outside the great dyke is likely to result, and it is considered that the danger of a serious flood in the case of the bursting of the right bank of the Prussian Upper Rhine would not be perceptibly increased.

With respect to the important question of the outflow of land water very careful observations have been made. It is found that the amount of water to be dealt with from the outflow of the Ysel, the other streams, the surrounding polders and the Zuiderzee itself stand in the proportions of 174, 111, 45, 36. It has been calculated that sluices with a depth of 13 feet, and a combined width of 1000 feet will amply suffice for evacuation sufficient to maintain the level of the projected Ysel Lake at the desired point. The evacuation of the existing polders

will be improved by the works, and their irrigation in the case of exceptionally dry summers will be very much facilitated, as the new Ysel Lake, unlike the present Zuiderzee, will be filled with fresh water.

The new scheme provides for the maintenance of all the important navigational features of the Zuiderzee. The actual navigation both by sail and steam is very great. Amsterdam, which supplies most of the trade, is yearly visited from the Zuiderzee by forty-six thousand sailing ships of nearly one million tons capacity, and by over eight thousand steamers, of an aggregate of 320,000 tons. When the great dyke is completed, water-communication between the outer sea and the Ysel Lake will be kept up by two canals. The first of these will lead from the open sea at Harlingen along the Frisian sea-dyke and through the east end of the Great Dyke to the Ysel Lake. The second canal will lead from the sea to the Ysel Lake across the island of Wieringen, and, as the lake will be kept in navigable connection with the principal trade towns now open to the Zuiderzee, sea-borne traffic will remain very much in its present state. The fisheries will, however, naturally suffer by the change from salt to fresh water.

The proposed seclusion dyke would require at least eight years for completion, the four inner dykes, and the polders they would enclose, twenty-four years more; and it would be undesirable for several reasons to occupy less time. The expense of the great seclusion dyke is estimated at about £3,500,000, and the four great reclamation works in the interior will cost about £12,300,000 more, a total cost of about £16,000,000. Against this must be set off the value of a little more than 530,000 acres of reclaimed land, of which nearly 500,000 acres may be expected to prove fertile. It is considered inexpedient to bring more than 25,000 acres of new land into the market each year; and of the estimated cost of £33 per acre, it would be fair to expect assistance from Government to the extent of a fourth part in respect of the improved condition of the kingdom with regard to danger from the sea. A fair rent for the reclaimed land may fairly be expected, probably £2 per acre, yielding annually an interest of over £1,000,000, when the reclamation is complete. The immense amount of employment for engineers and labourers, who at present have not sufficient occupation, must of itself be a national benefit.

Professor Telders of Delft gives, as his opinion of the scheme, that it is very difficult, but quite possible with Government aid. He considers that the construction of the secluding dyke will be more than repaid by the consequent cheapening in the reclamation of the Zuiderzee coast-lands, their ready evacuation or irrigation, and the establishment of direct railway communication between North Holland and Friesland. The outlay for roads, and possibly also for national defence, will be increased, but not out of proportion to the benefit secured.

Recently (September 8th, 1892) the Dutch Government has appointed a new Committee to report upon the scheme worked out by the Committee of 1886 (Zuiderzee-vereeniging). Of this new Committee, the Minister of Trade, Mr. C. Lely, is president.

MAP OF THE WORLD, 1542.*

THE original of this map is in the Royal Library of Stockholm, and is described in an accompanying pamphlet, by E. W. Dahlgren, as being drawn on three sheets of parchment, which together measure 1440 × 790 millimetres. The present reproduction is a facsimile in everything except the colouring, the ornamental border, and the inscription. As regards the general appearance and arrangement of the map, a reduced copy, which is also furnished, can be consulted. It will there be seen that the globe has been projected on the plane of the Equator, and divided into thirty-six gores, each of which measures 10° of longitude; but from the ornamental border and inscription, it is evident that it was not the intention of the author that it should be cut up and used as a covering for a globe. A scroll which runs the whole length of the map bears the following inscription:—

"Nova verior et integra totius orbis discripto nunc primum in lucem edita per Alfonsum de Sancta Cruz Cæsaris Charoli V. archicosmographum. A.D. MDXLII."

In the lower left-hand corner there is a dedication to the Emperor, surrounded by an ornamental border. As Santa Cruz participated in Sebastian Cabot's unsuccessful expedition of 1526, the object of which was to take the same course as Magellan, but which did not extend farther than the Rio de la Plata, it would naturally be expected that in that part of South America the most important information would be found. The results of this voyage had however already appeared on Ribero's two maps of 1529, and in this respect Santa Cruz's map has nothing of additional importance to present. It may however be remarked that we here for the first time find the name Rio de la Plata, and that the name Buenos Aires, which also occurs here for the first time, shows a knowledge of Pedro de Mendoza's expedition of 1535, when that city was founded.

The coast of Africa is evidently drawn from the charts of the beginning of the sixteenth century, such as the Cantino map of 1502. The mapping of the British Isles, Western Europe, and the Mediterranean exhibit, in a form modified to suit the projection, the coast-

* Map of the World, by the Spanish cosmographer, Alonzo di Santa Cruz, 1542. Reproduction in phototypic facsimile, by the printing office of the Swedish Staff-General, with explanations by E. W. Dahlgren, Stockholm, 1892.

line as shown in the Portolanos. The coasts of Arabia, Persia and India, are, with some slight changes, identical with those of Ribero. The farthest east, shown on the map, is Isla de Santa Cruz, an island a little to the east of Canton. The mapping of the East India Archipelago is very much the same as that of Ribero's maps of 1529, except that the south coast of Java and the east coast of Gilolo are shown.

The interiors of the continents contain but few names, and are for the most part occupied by quaint drawings of men, camels, elephants, ostriches, crocodiles, basilisks, etc. Of the rulers of different countries, so common in the maps of the sixteenth century, there is only one given, and that is a figure representing Prester John of Ethiopia, under which the following inscription is written: "A qui abita el preste Juan de las indias tienen tres bautismos de agua y fuego y sangre guardan la dotrina de S. Matheo." Every fifth meridian and every tenth parallel is drawn, and the degrees of longitude are reckoned both east and west from a prime meridian which runs a little west of the island of Fayal, and in the eastern hemisphere passes through Java and Annam, thus showing Asia as extending by about 40° of longitude too far to the east. On long. 20° W. the papal line of demarcation (Meridianus Particionus) is shown. It crosses America at the mouth of the Amazons, but assigns all the land east of the mouth of the Ganges to Spain, which is distinguished from that assigned to Portugal by the flags of each nation drawn on the southern hemisphere on either side of the line of demarcation.

In the accompanying letterpress a detailed description of the map is given, and a list of names that appear on it; these are printed in red or black according to the colours in which they appear in the original map. The work of reproduction, so far as it goes, has been carried out in a most satisfactory manner by the officers of the Swedish General Staff. It would, however, have been more satisfactory if the colouring of the original map had appeared, as it would then have been in all respects a facsimile.

A NEW MAP OF SWITZERLAND.*

THE task of the map-compiler, with regard to the physical features of the Central Alps, has been greatly lightened of late years. Specimens of the old Alpine maps engraved prior to, or without reference to, the Dufour Atlas or 1:100,000 Swiss map, are still extant in so-called modern atlases. But most cartographers have known how to avail themselves more or less of this material. Their difficulty has been with the southern slope, where the old Piedmontese and Lombard Surveys were very inaccurate. The late Mr. Nichols did his best to bring together the valuable

* Stanford's New London Atlas Map of Switzerland, scale 8 miles to 1 inch. London: E. Stanford.

work of Mr. Adams Reilly and other Alpine explorers in the beautifully-engraved Alpine Club map, published in four sheets by E. Stanford in 1874. The map, on a scale of 8 miles to an inch, now issued by the same firm has the advantage of dealing with a region, the recent government survey of which has, except in a few localities, been completed. The problem has been not so much to gather together trustworthy material as to reproduce on a comparatively small scale the material in hand in such a way as to give at once an accurate and intelligible bird's-eye view of the chief features of the Alps—their ridges and valleys, their snows and lakes. For the first time, in a map intended for a genreal atlas, the glacier region is clearly defined, and its comparative extent in different districts made visible at a glance.

The map has been drawn with the greatest care and nicety from the latest Swiss, French and Italian surveys, and the Alpine Club Map, on a scale of 4 miles to an inch, and then reduced by photography to half that scale, the artist-draughtsman's work being reproduced by sun-engraving with absolute fidelity. The result is very clear and intelligible, and, except that the relative steepness of the snows is not indicated, the sheet gives a very accurate idea of the general topography of the region depicted. In the special copies, a hundred of which only have been printed, no names have been inserted. Roads and railways, as laid down, have been carefully brought up to date, though in one or two instances slight omissions occur, *e.g.* the roads in Val Masino, and up the gorge known as the Via Mala Bergamasca in the lower Val Schilpario. The production of maps by sun-engraving, though largely and successfully practised in Austria and in other countries of Europe is, as regards Great Britain, an innovation, and it is to be hoped that the very satisfactory results obtained in the present instance may encourage map-producers in this country to make use of this process which has the advantage of giving an exact reproduction of the actual work of the skilled draughtsman, and therefore avoids all possibility of error after the work has passed from him into the hands of the engraver.

FLOODS IN QUEENSLAND.

By HENRY O. FORBES.

The telegraph has brought us during the past month distressing accounts of floods of a very disastrous character in the southern portion of Queensland. The districts which have suffered most severely are those lying near where the Brisbane, the Burnet, and the Fitzroy rivers fall into the Pacific, namely, the Brisbane in Moreton Bay, the Burnet in Hervey Bay, and the Fitzroy in Keppel Bay, along a coast-line of 420 miles. The details of the calamity that have reached this country refer chiefly to the districts in the

neighbourhood of the capital, Brisbane, where the floods seem to have been exceptionally disastrous. The city is situated in a deep bend of the river of the same name, 25 miles from its mouth, chiefly on its northern bank, but with an important suburb on the southern side. South Brisbane is connected with the city, as is stated in Wallace's 'Australasia,' by a "noble iron bridge more than 1000 feet long with two swing openings of 60½ feet wide each to allow the passage of ships," a statement which, though true up to the beginning of February is unfortunately no longer so. It is situated on much lower ground than the main part on the opposite bank, and it is naturally, therefore, the portion of the city in which the destruction of property and life has been greatest. In the west-end of South Brisbane we learn that only some twenty-five houses are left standing out of five hundred, and these were covered several feet deep in water, while between thirty and forty persons have been drowned. Those who had lost their homes were compelled to live in tented boats. The northern portion of the city is laid out in terraces rising to several hundred feet above the river, and consequently none of the important public buildings and chief residences would be imperilled. The streets by the narrow river-flat at the bottom of the rise have, however, suffered severely. The Botanical Gardens extend from the river-side on a steep slope up to the grounds of Government House, and it must, therefore, be their lower portions only that have been destroyed. They are situated at the western corner of the bend, and the river evidently taking a short cut over, has swept the flats in the centre of the city to the north-west of the Gardens, and the lower terraces of the Gardens themselves, carrying with it the two steamers—probably small river steamers, many of which have their anchorages a little farther round the bend—which have been stranded amid its trees. The chief loss the city has sustained is undoubtedly the destruction of the fine bridge already referred to uniting the two parts of Brisbane, which was erected at a great cost, and took nine years to build. It is reported that property to the value of £2,000,000 sterling has been destroyed in the town and suburbs; but, it is to be hoped that this may prove to be an over-estimate. This is not the first, though it appears to have been the most serious inundation that has befallen Brisbane, and the region now again affected. Only a few years ago the capital and many of the coast towns and districts were flooded, much property destroyed, and several lives lost.

The greatest amount of rain falls in Queensland during the summer months from December to February, and chiefly on the mountain ranges running north and south parallel to the east coast at distances varying from 20 to 100 miles. These ascend rather abruptly to broad plateaus of from 1500 to 4000 or 5000 feet above the sea. The rivers along whose lower reaches the floods have, according to our latest

information, been most destructive collect their waters over 8° of latitude, commencing in the north where the range runs out on to the coast, and extending south to the New South Wales boundary. Whether the Darling River, whose tributaries drain the western slopes of these ranges into the Murray and the Indian Ocean, and the Burdekin River,—whose southern affluent (with its branches), gathering its supplies from the western aspect of the same coast range, falls into the Pacific after running north through 5° of latitude,—participated in these floods we have as yet no intelligence. The Brisbane has much the shortest course of the rivers that drain this triangular area; but it has a steep gradient, and a very tortuous course, especially in the vicinity of the city, which by preventing a sufficiently rapid outflow into the bay, accounts for its great rise and destructive effects.

Some accounts state that the floods have spread "to the west of Brisbane, *viâ* Ipswich, as far as Toowoomba, the main town of the great agricultural district of Darling Downs." Ipswich, the second town of importance in the colony, is situated on the lowlands, and is a seaport at the head of the navigable water of the Brewer (a southern tributary of the Brisbane) River, 25 miles west of the capital, and may have suffered to some extent from the floods; but it is chiefly placed on hills rising considerably above the reach, we believe, of even very great inundations. But that Toowoomba, lying 100 miles west of Brisbane, could be reached by the floods from the lowlands is impossible, as it stands on the edge of the plateau of the Darling Downs, nearly 2000 feet above the sea. It is from Toowoomba that the western line from Mitchell, and the Great Southern Railway from Sydney and Adelaide, descend the abrupt escarpment facing the Brisbane plain, by a well-known zig-zag line. It is probable, however, that the heavy rains on the plateau may have caused damage to the town and that famous agricultural district, or to this railroad which in its descent crosses numerous ravines which no doubt were converted into raging torrents.

Past the town of Gympie, 116 miles north of Brisbane, runs the Mary River, which drains the northern slopes of the watershed of the Brisbane River, and flows north by Maryborough—on the alluvial flats 25 miles from the mouth of the river—into Great Sandy Strait. All along this river, therefore, as might be expected, great damage has been done to private and public buildings, while the gold mines round the former town—the richest and most important in South Queensland—have been filled with water, and will be unworkable for a long period. The Fitzroy, which passes Rockhampton and enters the sea in Keppel Bay, has tributaries along 380 miles of country from north to south and for nearly 200 miles to the west, where the western edge of the plateau recedes farthest from the sea; the amount of water, therefore, which it must collect from this area during sudden or long-continued rains must be enormous, and it is not surprising to learn that there has been great

devastation along its banks and in Rockhampton, which lies 40 miles from the sea. The southern coast hills have, as a rule, a less rainfall than the northern, and their eastern slopes receive more than their western. On the high coast plateau 30 to 70 inches per annum fall on the east side, while on the west side 15 to 30 inches only are registered. The southern parts of these ranges appear to be periodically subject to unusually heavy rains, and their rivers, either from their steep gradients or the enormous extent of their catchment basins, produce floods along these 400 miles of coast-line, and doubtless in some parts of Victoria, as the Condamine, one of the great tributaries of the Murray, rises in the Darling Downs. It will be evident by a glance at the map that the whole of the region which has recently been inundated in Queensland, as well as much of Victoria, might be affected by a sudden heavy or continued rainfall over a comparatively small region north-west of Brisbane, restricted to the eastern parts of the Darling Downs, and the southern part of the Burnet, and the eastern corner of its neighbour, the Leichardt country, as the Condamine and all the rivers discharging along these 420 miles of coast—from Rockhampton to Brisbane—rise in or receive important tributaries from this circumscribed area.

DISTRIBUTION AND MOVEMENT OF POPULATION IN INDIA.

THE results of the late census of India, with regard to the distribution and movement of population, were put before the Royal Statistical Society, in a paper read in December last by Mr. Baines, the Census Commissioner. These subjects being intimately connected with the varying physical features and climatic characteristics of different parts of the country, it is impossible to deal with the latter as a whole. Taking these two points into consideration, and omitting the mountain frontier, only a fringe of which is touched by the census, India may be broadly subdivided thus: Firstly, come plains, some drained by large rivers, with a certain rainfall; others (in the meeting zone of the two branches of the south-west monsoon) fertile, but with more uncertain seasons; and one (in the lower Panjab and Sindh) either desert, or dependent for crops on irrigation. Next, we have the tablelands of the Deccan, &c., still more liable to deficient rainfall, from their situation between two monsoon currents, and with, accordingly, less productive soil. Thirdly, the forest-clad hill tracts, between the latter and the plains, with fairly abundant rain, but of which no large proportion is arable land. Lastly, the coast-strips, mostly fertile, and in the extreme south, a tract with good soil, but capricious rainfall. The average density of population in India, 184 to the square mile, is not great, but there is great unevenness in its distribution. In British territory 45 per cent. of the population occupy only 16¾ per cent. of the area with a density more than double the mean for the whole, which is 230. In two districts, in Eastern Bengal and along the Goghra, a maximum of 790 is reached; yet even here, owing to the great natural advantages, the pressure on the land is probably no greater than in other less fortunate tracts with a much smaller density; as, *e.g.*, the east of the Deccan and parts of Madras, which, with a light soil and precarious rainfall, support only 122 to 150 per square mile. On the other hand, wide tracts are capable of supporting a much larger population than the present.

Thus, Assam, excluding the Surma Valley, has only 76 inhabitants to the square mile. In Madras, apart from the unlucky tract above mentioned, we find a more evenly distributed population, and an average (252) more nearly approaching the general one. In the Native States, as a whole, the figures are lower, and even where, as in Travancore and Cochin, they exceed four hundred, there is little complaint of congestion. The agricultural propensities of the population make the tendency to congregate in towns weak. Even the return of 9½ per cent. for town-dwellers is fallacious, owing to the inclusion of small market centres, while towns of twenty thousand inhabitants and over contain only 4·8 per cent. of the population. As to the rate of increase of population in the decade, the mean of 11 per cent. cannot be called excessively high, considering the absence of retarding causes. For British territory the rate seems on the whole to diminish as the density increases. Of the different causes of variation statistics as to the ratio between births and deaths are still wanting. Against the prevalence of marriage we may set the mortality among child-mothers and their infants, while the population is never long-lived. The effect of famines is probably felt for some time afterwards, while that of epidemics is always present. Migration, except to Assam and Lower Burma, plays a very small part, and the returns are perhaps swelled in some cases by the interchange of wives between contiguous villages. Only 3½ per cent. of the population were born beyond the territory immediately adjoining that in which they lived. The greatest increases (as in Lower Burma and Sindh) have been due to agricultural expansion, but the slowness of movement to new country from any distance, is shown by the normal rate in the Central Provinces in spite of their great advantages. The towns which show most advance are the seaports, manufacturing towns, and military stations, while in British territory the old centres tend rather to fall back. On the whole the growth in material prosperity has kept pace with that of population.

THE REGULATION OF THE IRON GATES.

In a report presented to the Fifth Congress of Inland Navigation at Paris (1892), M. Béla de Gonda, Professor in the École Polytechnique at Budapest, reviews the problem of opening the navigation of the Lower Danube, and gives an account of the various attempts made to solve it since the fourth Scythian and fifth Macedonian legions carried out the plans of Damas Apollodorus in the time of Trajan. The interruptions begin below the town of Bazias, where the Danube quits the Hungarian plain, and terminate at the Iron Gates about 80 miles further down. From Bazias the Danube follows an easterly course between the Lokva and Rama mountains for some 30 miles, crossing the strike of the crystalline schists composing them almost at right angles. At Kozla, it turns to the south-east, and thence to Svinicza crosses the beds of rock at an acute angle, which increases as the stream sweeps round again to a north-easterly course at Jucz. From Plavisevicza to Ogradina the river follows the longitudinal axis of a geological valley, and then again turns eastwards and south-eastwards at Orsova, near the frontier of Hungary and Rumania. Between Ogradina and the Iron Gates the river-bed is cut across the granites and schists of the mountains which join the Balkans and the Transylvanian Alps. The geology of the region, which the Report discusses in some detail, is somewhat complex, chiefly on account of the variety of deposits overlying the igneous rocks, some of them rich in copper and in coal; many of the sections, exposed by the action of the river are of extreme interest.

The Danube is for the most part navigated by vessels drawing not more than 6 feet, and the interruptions between Bazias and the Iron Gates are to be regarded as such only in so far as they interfere with vessels of that draught; there is no question of opening the upper part of the river to sea-going ships. The ordinary season for navigation extends from March 1st to November 30th, and the passage of the Iron Gates, at all times difficult and dangerous, is on an average of 40 years altogether impracticable for boats drawing even 5 feet during 117 out of the 275 days, sometimes on account of the extreme velocity of the rapids, but more frequently through insufficient depth of water over the shoals. Starting from Moldova 20 miles below Bazias, where the Romans worked extensive copper mines, and following the river downwards, we find first a rocky shoal about half a mile in length deflecting the main current to either side, and widening the bed of the river to about 1¼ mile. Below this shoal the Danube first enters the narrows; the rocks on the left bank come close down to the river, and in less than a mile the breadth is reduced to 440 yards, the isolated "stack" of Babakay standing as a tell-tale at the head of the funnel. The depth, which in the dry season is from 7 to 10 feet at Moldova, suddenly increases to 70 and even 120 feet, gradually shelving up till at Alibeg, 3 miles further down, it again decreases to 20 feet as the stream becomes wider. At Stenka, 7 miles below Moldova, the first really dangerous rapid occurs, the river narrowing to about 1000 yards; but there is always sufficient depth of water. The first station for "portage" is at Drenkova, 5 miles further on, and immediately above the point where the river turns to the south-east. Below the turning the mountains on the left bank again advance into the river-bed, while the Kozla shoal forms a barrier on the opposite side. The current is then driven against a rocky reef at Dojke, which reflects it almost at a right angle, and the mountains close in on both sides, reducing the channel to little over 400 yards. From this rapid, which is about 1½ mile in length, a comparatively clear reach extends to the rapids of Izlasz and Tachtalia, about 23 miles from Moldova, which ranks second only to the Iron Gates. At Izlasz, after narrowing to some 400 yards, the bed again widens, is crossed first by a bar and then by two shoals named greater and smaller Tachtalia, and immediately below is again contracted by the precipitous chalk cliffs of Greben. The narrow channel is beset with dangers—from shallows in low water and whirlpools in flood.

Next follow 30 miles of wide placid river, too shallow in places and broken during low water by a rapid at Jucz. The Danube then enters the pass of Kasan, at the entrance to which are the famous caves of Punjikowa and Veterani. Except at Dubova, where the bed opens out considerably for about a mile, the river flows to Ogradina, a distance of 6 miles, between walls of rock seldom more than 250 yards apart. There is here, however, little obstruction, the great depth of the channel (100 to 180 feet) preventing a serious rapid.

Then again the river widens, and turning more southward flows past Cserna, the ancient Tierna, where the remains of the Hungarian army buried the Hungarian crown in 1849, past the island-settlement of Ada-Kaleh (Uj-Orsova) which, after being alternately fortified and demolished for two hundred years, was taken over by the Austro-Hungarian monarchy in 1878, with an undertaking to protect its Turkish population, past the frontier town of Vodinca, and finally, a mile further on, enters the Iron Gates. There the channel, shallow and rocky for nearly 4 miles, is barred by the Prigradu reef, a wall over 350 yards wide, emerging above the surface at low water, which runs near the left bank for over a mile, and then crosses diagonally to the right just above Sibb. This wall, with numerous smaller reefs, extending to some 2 miles in all, constitutes the Iron Gates proper, and forms a dangerous cataract throughout its entire length.

The principal obstacles therefore occur at Stenka, Kozla to Dojke, Izlasz and Tachtalia, Greben, Jucz, and the Iron Gates, and at each of these points either the channel must be deepened or the difficulty of mounting the rapids diminished, or both, if navigation is to continue without interruption during the season, or, indeed, free of danger at any time. The Roman engineers avoided only the Iron Gates, cutting a canal on the right bank of the Danube through the whole distance. For the other obstructions they trusted to haulage, and constructed a stupendous towing-path, the *Trajani Via*, parts of which still remain. After the decadence of the Empire, the banks of the Danube became the scene of constant struggles with the Turks, and the question of navigation lost its importance. When the Turks were finally driven out of Hungary and peace restored in the beginning of this century, the Hungarian Council again took the matter up, and in 1816 ordered a survey to be made, which was executed between 1823 and 1838, with much opposition from the Turkish authorities. In 1830, Count Széchenyi attempted actually to begin the work of clearing the river, but in face of the political and engineering difficulties on the right bank thought it best to improve the land communication by constructing a thoroughly good road on the left. The necessary funds having been voted by government Széchenyi commenced operations in 1834, and the road was completed in 1837. The problem of navigation, however, came again into prominence after the Crimean War, and several fresh surveys were made, but without any practical result, until the matter was taken up by the Berlin Congress in 1878. On July 8th and 13th of that year the Austro-Hungarian government concluded treaties with Servia by which the former undertook to open the Lower Danube, without pecuniary sacrifice on the part of the latter, who were to enjoy full privileges, in consideration of their affording all facilities for the execution of the work; the moneys expended to be recovered, in terms of a former treaty, by tonnage dues. After further delay, caused by financial difficulties, plans based on a final survey were submitted to the Austrian, Servian, and Rumanian governments in 1883, and a law authorising the undertaking was passed in 1888, the cost being fixed at nine million florins. Contracts were placed with a syndicate, and signed in May, 1890, and operations formerly inaugurated on September 18th, 1890.

The international work laid upon Hungary at the Berlin Congress closely follows in its main features that of the Roman engineers. Shallows are removed in part by deepening the channel, in part by the erection of dykes, and rapids are overcome not by canals with locks, but by smooth channels and ample towing power. Its completion may be looked for in the end of 1895.

THE INDUSTRIAL DEVELOPMENT OF NYASALAND.*

By JOHN BUCHANAN, C.M.G.

NYASALAND may be said to be situated between 17° S. and 9° of N. latitude, and 36° E. and 33° W. longitude. It is now reached by the Chindé mouth of the Zambesi. Until the discovery by Mr. Rankin of the Chindé as a navigable river, Nyasaland lay under the great disadvantage of not being accessible save through the territory of a foreign power. We proceed up the Zambesi till we meet the Shiré. This river is followed to the confluence of the Ruo, which, on

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* Paper read at the meeting of the British Association at Edinburgh on August 8th, 1892. Revised and extended for *The Geographical Journal*.

the left bank of the Shiré, forms the British frontier. We may continue to follow the Shiré, depth of water permitting, to Blantyre Port, 10 miles below the Murchison Cataracts, or we may proceed overland from the Ruo to Blantyre or Zomba, and downwards to Lake Nyasa. There is a passable waggon road from Katanga or Blantyre Port, on the Lower Shiré, to Matobe, on the Upper Shiré, that is from below to above the Murchison Rapids. At present, however, tsetse fly blocks the upper end of this road to cattle. A road is being constructed by Captain Sclater, R.E., of the British Central Africa Administration, from Chiromo to Lake Nyasa *viâ* Zomba, and it is by no means chimerical to expect that at least a steam tramway may be in working order on this road within the next five years; greater advances have in the past taken place in Nyasaland within shorter time. Travellers from London to Nyasaland may reach Zomba or Blantyre within seven weeks. Recently I have had letters within five weeks from the date of departure.

Nyasaland is composed of mountain, hill and valley, lake and river, from the ever-present ant-hill to the magnificent Milanje Range, 9000 feet above sea-level, and from the tiny rill trickling forth from secluded spots in the depth of the forest to Nyasa itself, with its 350 miles length of placid blue, peacefully reflecting the unclouded canopy of heaven, or lashing green-crested waves shorewards, thundering and breaking on the beach like the ocean itself. The physical aspect of this district may be said to be represented by a series of undulating plateaux, from 2000 to 4000 feet above sea-level, studded with hills and miniature mountains, clothed to the summit with bush and forest trees, or showing only bald rocks, among which grow euphorbia, and aloe, and tufts of wiry grass, the latter a living exponent of the parable of the sower—exuberant and green while the rain lasts, rapidly passing through a transition stage to sere and lifeless when the supply of moisture fails.

Central Africa has for so long been associated with the idea of barren, arid tracts of waste land that it must be a relief to know that while that description may be true of one or two spots, it is totally inapplicable to the land under consideration. This is a well-watered country. On the mountain sides each ravine has its stream or burn shaded by bracken and bramble.

A prominent feature in the physical aspect of Nyasaland, as in many other parts of Africa, is the grass land which occurs in patches, it may be of acres, or it may be many square miles in extent; these grass lands are known to the natives as "dambo" or "lilambo." They are, as a rule, void of all trees save a species of Eugenia and Protea, and rest, I believe, on an impervious subsoil. During the rainy season the surface soil acts like a sponge, absorbing water till thoroughly saturated, at which stage it becomes virtually a marsh, and the water gravitating to the lowest level forms the nucleus of a stream, or as the natives have it "nduluko." Streams thus formed are, in the cases of some of the larger of these "dambo," almost perennial, but in the majority of cases, drainage and evaporation together exhaust the supply, and the "dambo" in the dry season becomes the driest of the dry places. There are, in addition, on the plateaux depressions large and small, having a great depth of loose soil, acting as a reservoir into which considerable extent of surface and underground drainage gravitates, and forming a nucleus for a perennial stream. These depressions are known to the natives as "litimbi," and form a very important part in the economy of agricultural life. Resting as they usually do on a subsoil of rock or tenacious clay, they have become enormously fertile through the surface-wash of ages having been deposited in them. In certain of them, which I examined by cutting a deep drain, I found that a perpetual ooze existed on the hard subsoil beneath the loose surface soil, the result of this being

that during the dry season capillary attraction brings to the surface sufficient moisture, which enables the natives to cultivate early crops of maize, beans, pumpkins, etc., while in the rainy season they become veritable sloughs, covered with rank coarse vegetation, into which no man can with safety enter. The drawback to open draining these places is, as proved in my own case, a danger that the surface soil during a deluge of rain slips off the hard under-stratum and is carried away, especially so should the depression be on a slope. On the mountains themselves, for example Milanje and Zomba, at an elevation of 6000 feet above sea-level, we have these depressions, which, as in the case of Zomba during a very wet season, assume the appearance of a small lake. While, therefore, the perennial water supply of Nyasaland comes from mountains and hills, and the streams, in consequence, may be widely separate, we have, owing to these grass lands and depressions, a supplemental supply which very largely benefits the country far on into the dry season, and would be available for the making of dams were the occupancy of the country to demand it.

The rainfall in Nyasaland varies considerably. In the Shiré highlands the average is about 52 inches, while on the lake it may average 80 inches or more. During the last ten years, while so far as I know there has been no marked change in the fluvial aspect of the seasons, there has been a decided falling in Lake Nyasa, and a drying up of the Shiré River. At no time within the last sixteen years was the Shiré River so low as in 1891. The Shiré is dependent on Lake Nyasa for its permanent supply, but, what is also of importance is, not that a certain quantity of rain should fall annually, but that the duration of the rainy season should be prolonged.

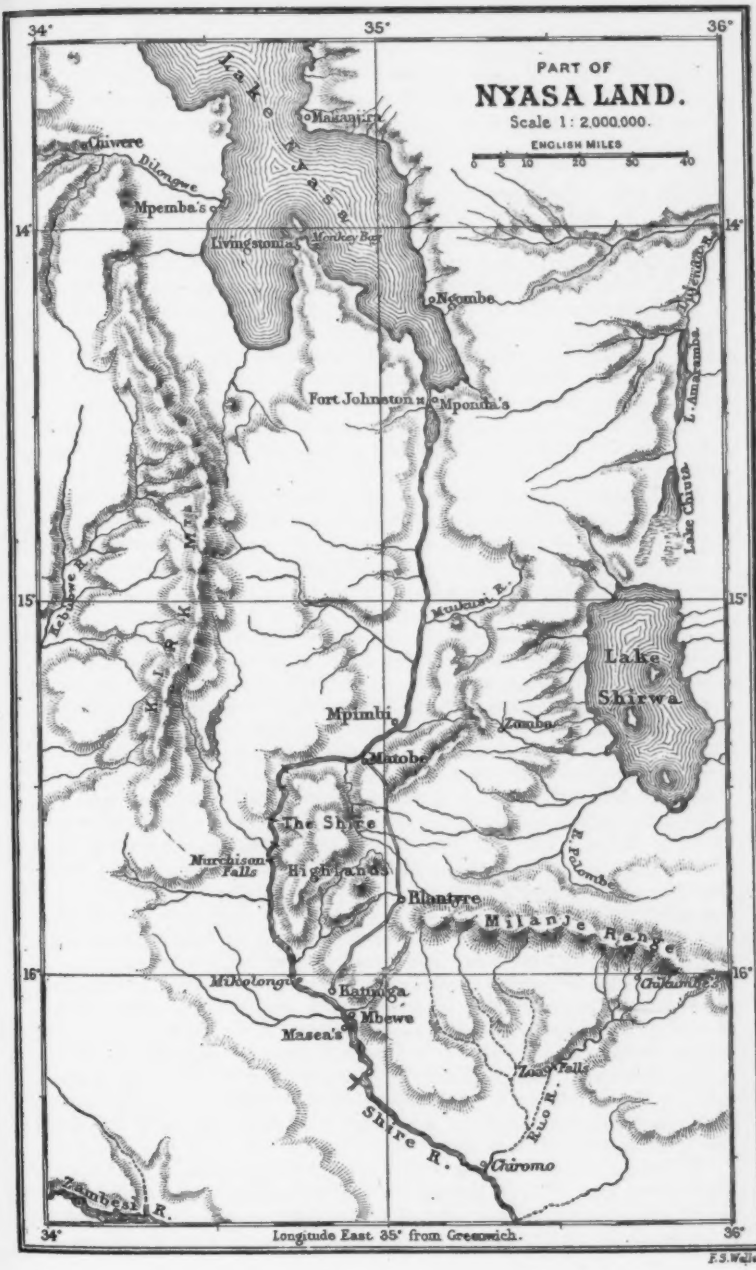
In 1879, Lake Shirwa was almost completely dried up. Yet notwithstanding, while last dry season was the most severe of any yet experienced by Europeans, there was more water in Lake Shirwa than in 1879. At the north end of Lake Nyasa, old natives will point to a ridge of sand ten or more feet in height above the present level of the lake, and tell you that they remember the water being at that point, while there is undisputed evidence from observations to show that the present average level of the lake is several feet below what it was ten or twelve years ago. Lake Shirwa, which may be looked upon as neither more nor less than a vast flat basin, has receded on the western shore at least a mile within the memory of lads under 25 years of age. Yet there has been no sensible diminution in the rainfall of the eastern Shiré Highlands to account for this. At the present moment, meteorological data are of the most meagre kind, but the comparison of a few years' observations, taken in many and varied positions will, I have no doubt, render the problem as to this desiccating influence soluble, and I am sanguine enough to believe that it will be found that the quantity of rainfall is not lessened, but that probably within certain cycles the duration of the rainy season is shortened, and evaporation in consequence does the rest. The cutting down of timber up to date, though bad enough, could have had no serious effect. May not another solution be the gradual rising of this part of the African continent?

The seasons may roughly be divided into four, corresponding to our spring, summer, autumn, and winter. In the end of September, and in the early part of October, notwithstanding the absence of rain, increased temperature causes vegetation to revive; trees and shrubs seem able from stores, elaborated during a period of rest, if rest there be, to start forth and carry on almost into full leaf. It is a trying time alike for plants and planter. When only bush and forest are at stake, and Nature can take her own time to repair the damage, the loss may be small; but it is different when fields of coffee are at stake. The best planting months are November and December, and the best growing months December, January, February and March.

In April, May and June, crops are reaped. June, July and August are the coldest months, when vegetation is outwardly, at least, less active. August sees the great bulk of these trees bare. Few are the non-deciduous trees in Nyasaland, for though by stream and river one sees an evergreen line, it is situation rather than habit that accounts for it.

When I say that Nyasaland is well-wooded, it is not to be understood that we have anything approaching the forests of the Amazons, or the districts recently traversed by Stanley. Ascend hill or mountain and you overlook an apparently densely wooded country, with occasional dark patches of primeval forest, whilst well-defined lines, prominently above the surrounding woodland, indicate the existence of streams or moisture. On close examination this forest proves to be only collectively so; the great bulk of the trees that constitute forest in Nyasaland being from 4 to 12 inches in diameter, and from 8 to 16 feet in height. There are, however, places where this description would not be applicable, and where trees have attained greater size in girth and height, and stand widely apart; the intervening spaces being covered by low scrub and bush. On the plains of both the Lower and Upper Shiré, a marked feature of the landscape is formed by groups of giant acacias and others distinctly separate from one another, fringed by tangled briar and straggling thorn, as if Nature had resorted to a picturesque though artificial method of arrangement in adorning what would otherwise be a monotonous plain. The baobab and kigelia are ubiquitous. The acacia, in the struggle for existence, has acquired the property of exclusively establishing itself in deep dark soil, on level plain or mountain slope. *Khaya senegalensis*, the great canoe tree, *Erythrophlæum quinense*, the bark of which is used in the poison ordeal, *Parkia filicordia*, *Albrizzia fastigiata*, *Eugenia cordata*, and species of Ficus constitute the leading features of arboreal life by stream-side in the highlands; while species of Pterocarpus, Terminalia, Vitex, Lonchocarpus, Napuca, Brachystegia, preponderate on the undulating plateaux, vast tracts being covered almost exclusively by species of the last-mentioned genera. Recently there has been brought to light a species of conifer of the genus Widdringtonia, found on the top of Milanje at an elevation of 6000 feet. These trees measure in some cases 5½ feet in diameter, at 6 from their base, with a clear straight stem of 90 feet, the crown attaining to a height of 160 feet. These arboreal monsters were first brought to our notice by the late Rev. Robert Clelland; the investigation and procuring specimens of them is due to Mr. Alexander Whyte, Naturalist to the British Central Africa Administration, who has already done much, and will doubtless accomplish more in bringing to light hidden objects of scientific interest in Nyasaland. There are already growing in the Residency garden numerous seedlings of this tree, and as the timber is of a valuable nature, efforts will be made to plant it extensively.

From a utilitarian point of view, Nyasaland may be said to be decidedly wanting in timber, though that there are certain available and valuable woods there can be no question. On the lower Shiré and Zambesi a Pterocarpus, a kind of almug, is used largely for boat-building; natural knees of the Kigelia form durable ribs for boats; *Eugenia cordata* and kindred species we have found to be excellent timber, close-grained, easy to work, and possessing the invaluable quality of lasting well in water, as experienced in a water-wheel at Zomba. It is worthy of notice that this tree is only to be found in wet situations, found often where no other save an imbibing Ficus would survive. Terminalia is also a good wood, short-grained and strong; in *Khaya senegalensis*, the canoe-tree of Nyasaland, we have a first-class wood, a kind of coarse mahogany. In a species of Bridelia we have a wood almost equal to walnut; in *Erythrophlæum quinense* we have a kind of coarse teak almost imperishable. *Vitex umbrosa* affords a wood light and easily worked, useful for furniture or inside work, where it can be protected; while the *Napuca kirki*, though


PART OF
NYASA LAND.
Scale 1: 2,000,000.
ENGLISH MILES
0 5 10 20 30 40
34°
35°
36°
14°
15°
16°
Lake Nyasa
Makanjira
Chiwere
Dilongwe
Mpemba's
Livingstonia
Monkey Bay
Ngombe
Fort Johnston
Mponda's
Lake Chiuta
Lake Shirwa
Mulanje R.
Mpimbi
Zomba
Matobe
The Shire
Murchison Falls
Highlands
Blantyre
Milanje Range
Mikolongwe
Katunga
Mbewe
Masea's
Zoss Falls
Shire R.
Elio R.
Chiromo
Zambesi R.
Longitude East 35° from Greenwich.
F.S. Weller.

the most common, is perhaps the most useful, certainly the most extensively used wood in the Shiré Highlands. For bridge-building, where durability and great strength are required, Mwenya, a tree resembling a giant larch, with rhododendron-shaped leaves and a wood so dense as to sink to the bottom in water, cannot be beaten. Few are the woods that stand exposure to wind and weather in Africa; fewer still that are proof against the ravages of white ants. We have, however, in Pterocarpus, Bridelia, and Erythrophlæum, specimens possessing this quality. I have seen trunks of the first that have lain on the surface for twenty years in a good state of preservation; while in a species of Louchocarpus, a bastard rosewood, we have a timber that will for years, underground, defy the ravages of termites. The weak point in Nyasaland timber-supply is not that trees are wanting, but that wood of a durable workable quality, obtainable in large quantities, is not to be had. Notwithstanding there being no likelihood of a cubic foot of timber being exported for commercial purposes, we need not take a too pessimistic view of the case; for with better methods of treatment of timber, preservation and conservation of forest, and the amelioration of the present system of native agriculture, whereby, as in the case of Blantyre and Mandala, the country has been virtually devastated, together with a little attention paid by white settlers to reafforesting, timber sufficient to meet internal requirements will always be forthcoming. Already a good deal has been done in the way of introducing blue gum and other trees, and though, in the case of a eucalyptus avenue planted at Zomba, white ants attacked and destroyed the *living* trees; there is at Blantyre a eucalyptus avenue, planted in 1879, boasting of trees 2 feet in diameter, and close on 100 feet in height, *Eucalyptus globulus* being the quickest grower.

Passing to the soil, on which a country's wealth so largely depends, Nyasaland possesses a great diversity. In the Shiré and other valleys there are large tracts of alluvial deposit capable of producing enormous crops of grain, rice, sugar-cane, oilseeds, cotton, etc., but it is to the undulating table-land and mountain-slopes where Europeans can live, and where crops are moderately secure from flooded rivers and excessive moisture, that we must look for the profits of labour. The surface soil of Nyasaland, varying in depth from 4 inches to several feet, greatly diversified in quality, and ranging in colour from a light-blue sand to a jet-black loam, rests generally on a ferruginous clayey subsoil, which again rests upon coarse, rotten granite, affording ample scope for the exercise of skill and agricultural knowledge in the selection of land. Native agriculture, though possessing great interest, must, I fear, be passed over. Suffice it to say that while the devastation of forest is most reprehensible, and the natives themselves cannot give you any reason for their system, they in a sense, practice the essence of agriculture in their methods of maize and sorghum and sweet-potato cultivation, in which ashes and burnt earth play a prominent part, notwithstanding the great waste.

Several of the food-stuffs at present cultivated in Nyasaland are of comparatively recent introduction; and one can trace various food-producing plants already reverted to a wild state that had been cultivated prior to the introduction of maize, cassava, sweet potatoes, etc., and still available, though sadly deteriorated, in seasons of hunger. Crops cultivated by the natives may be summed up in maize, sorghum, rice, millet, beans, sweet-potatoes, yams, bananas, ground-nuts, sem-sem, ginger, turmeric, cotton, hemp, and tobacco; all of which, according to soil and locality, grow freely, and yield abundantly.

We have now to look at our subject from a purely commercial point of view. We have, to start with, in Nyasaland the cardinal elements of commerce. In many parts soil of almost unlimited fertility, abundance of land of average richness, a comparatively healthy climate, natives who, taking them all round, are far

beyond the average African in point of intelligence and willingness to work, access to the London market, which will improve, and security to life and property afforded by the British Central Africa Administration. I have already stated that grain in the shape of maize, rice, sorghum, beans, etc., can be grown to an unlimited extent; the home demand, however, in an ordinary season, meets the supply, and a high freight nullifies any attempt to grow these grains for export. On the Zambesi a species of wheat is grown which, though not very prolific, produces flour of superior quality, and finds a ready market among the Portuguese and other Europeans on the coast. In the Shiré Highlands European wheat has been grown successfully from time to time, though on several occasions rust proved a deadly foe. Sem-sem and ground nuts support a large trade on the Zambesi and Shiré, and are a sure article of export and a greatly extended cultivation of this product on the lowlands may be reasonably anticipated. Flax, too, we found to grow well in ordinarily good soil. Castor-oil plants (Ricinus) are weeds everywhere, there being nearly thirty varieties. The seeds are worth in London about £8 per ton. Cotton grows on plain and hill. The indigenous variety has been reported upon as being too short in the staple to be of value as an article of export, its probable use being for the manufacture of candlewick, but we have introduced several leading Egyptian and American varieties, all of which were doing well.

As to fibres, we have species of Sanseviera on hill and plain, which are worth in the London market from £20 to £40 per ton. The natives make rope from the *Sanseviera longifolia*, which they sell to the Europeans. On the shores of Lake Nyasa, and at Cape Maclear in particular, is a bush known as "tingo." This plant, resembling a willow in habits, sends up a number of hazel-like shoots from 2 to 5 feet in length, which, on being cut and the outer bark scraped off, are laid for a few hours in the sun; afterwards the inner bark is removed and manufactured by rubbing and washing, and then spun into twine, the loom being the human limb. Fishing-nets are made of this twine, and resist the action of the water for a considerable period. Nets for the chase are made from the inner bark of the baobab. From the liber of the "njombo," the *Brachystegia longifolia*, and kindred species, as also from species of Ficus, the native bark cloth is made. The last-named, as cloth and cordage enters so largely into the economy of everyday life, that on the lake ficus-trees have become heritable property, while the "njombo" and others, through their accommodating facilities, have so impressed the native mind with the idea of tying, that the verb build has no place in their language, no structure being built but *tied*. Is it not too much to express the hope that these bark-cloth trees, which have played so prominent a part down the roll of Africa's dark days, may find a still higher use in these advancing times. Both rhea and aloe fibre plants (*Fourcroya gigantea*) have been introduced and grow luxuriantly. As to rubber, several species of Landolphia are found all over the country, and good prices have been obtained in the London market. The supply, however, is fast disappearing; the native method of collecting is most destructive, and it seems hopeless to educate the natives in this respect owing to their advanced ideas regarding the common rights of property.

I need hardly refer to ivory. Every one has heard of the terrible evils connected with this trade. There must still be great stores of ivory in the interior of Africa. I need not burden this paper by detailing such articles as hides and horns, gums, chillies, ginger, turmeric, etc. These, and others I have mentioned, are marketable, and may become valuable commodities. Much depends upon cheap freight and upon speedy communication with the London market.

But we still want a staple; we want a commercial backbone. No; we are sanguine enough to believe we have found this in coffee. It is now fourteen

years since, through the kindness of the late Professor Balfour, three coffee plants were presented to the Blantyre Mission. These plants were packed in moss in a flat box, and under the care of Mr. Duncan, who occasionally opened the box and damped the moss, they reached Blantyre after a three months' journey. Two of the three subsequently died, one each of *Coffea Arabica* and *C. Liberica*; the other *C. Arabica* survived, at first grew slowly, but ultimately blossomed forth into flower and fruit. Progress in coffee planting was at first slow, and attended with great risk, the real impetus being given by the declaration of a British Protectorate in 1889. The season of 1892–93 will see about ten million coffee plants planted out in the Shiré Highlands, and this we believe is but the day of small things. Coffee grown by Messrs. Buchanan Bros. at Zomba has fetched a high price in the London market, the feature of the Shiré Highland coffee being a small but compact bean of high flavour. There are of course certain difficulties in the way of coffee extension and successful cultivation, as in everything else. The labour question is already exercising the minds of most planters. We have suffered a good deal from what we might term the "empty-berry-foe"; borer, too, is ever cropping up, but nothing approaching *Hemilea vastatrix* has been observed.

As I have stated, the coffee at first grown was *Coffea Arabica*. We have now, however, Blue Mountain and Orange coffee, as also *Coffea Liberica*. Blue Mountain coffee seems well suited for an elevation of 3000 feet, while the "Orange" coffee, though it bears well at that elevation, is less hardy. *Coffea Liberica* produces fruit at Blantyre at an elevation of 3300 feet above sea-level, but at that elevation it would not be a profitable crop. Much may be done with it, however, on the lowlands.

Another species, the *Coffea Mozambiquensis*, is worthy of notice. Presumably indigenous to the country, though so far as I know confined to the sea-level, it has proved itself capable of resisting intense drought at an elevation of over 3000 feet. It has the peculiarity of completely shedding its leaves before coming into flower, it is in fact deciduous. It is a perfectly distinct species both in leaf and fruit and habit of growth. The fruit is very small, but ripens in an incredibly short time.

As to tea, an experiment of 20 acres is being tried at Zomba. Tea has been grown in the Blantyre Mission garden for years, but, considering the present absurdly cheap price of tea, and bearing in view the necessity for having an absolute command of labour for its growth at a time when the natives are most busy with their own gardens, I think it doubtful whether tea will ever rank as a paying product in any part of Central Africa.

Ceara rubber we have introduced, and found it to grow well. There is a great possibility in Ceara rubber, but immediate returns must not be looked for. Notwithstanding the nonsense that has been written as to Ceara requiring only a few stones drawn together, or a hole made with a crowbar and a cutting inserted to ensure success, our Nyasaland experience is, that no plant is more partial to good soil, nor less likely to repay the planter in a bad one.

Alongside of coffee may be considered cocoa cultivation; the difficulty of securing a supply of plants has been, hitherto, the drawback. This, however, has been overcome, and success is anticipated.

Cinchona may be looked on as an auxiliary. A small parcel of four-year-old bark of so-called Calisaya Verde, grown at Zomba, at an elevation of 3000 feet, realised 4d. per pound. The following is an analysis of the sample.

Crystallised sulphate of quinine	3·81 per cent.
Cinchonidine	1·42 ,,
Quinidine	0·15 ,,
Cinchonine alkaloids	0·56 ,,

Though the palmy days of cinchona cultivation have long since departed, given land and labour cheap and plentiful, there is yet a great possibility in cinchona to the man who can afford to wait.

Sugar might be cultivated to an unlimited extent on the lowlands. It is grown and manufactured at Zomba for local consumption; but as it is practically a two-year crop in the highlands, profits from it are small. I have never looked upon sugar as an article of export from Nyasaland, though local demand can always be met.

Tobacco is cultivated by the natives and cured in different ways, and some of this article as manufactured by them is highly prized. From imported seed a finer leafed tobacco has been raised, and a sample of Zomba tobacco was described by a London broker as the finest yet seen from Africa. The native tobacco lies under the disadvantage of being coarse-veined, thick and heavy in every way, totally unsuited for any save the coarsest uses in the home market. Both cut tobacco, cheroots, and cigars, are being manufactured at Zomba for local supply, and, while this is met, planters may look forward to exporting the raw material. A superior tobacco can be cultivated; experience in curing and growing will adapt it to the market.

I feel justified in saying that, commercially, Nyasaland has a bright future before it. We have the backbone of commerce in coffee, cocoa, rubber, tobacco, cotton, cinchona, and it may be, tea, and sugar, and in an already organised trade in oilseeds, capable of unlimited extension, with great probabilities in fibres, grain, hides, beeswax, etc., not to speak of the ivory trade, which will hold its own for several years yet to come.

The development of Nyasaland, considering the circumstances, has been I believe, unique. In June of last year 1891, we entered upon a new régime. It is unnecessary in this place to do more than mention the fact that a Commissioner, in the person of Mr. H. H. Johnston, C.B., sent out by Her Majesty's Government, began to administer the country.

Before concluding, I wish merely to ventilate a railway scheme for British Central Africa which has been in my mind for years. It is simply that we should construct a railway from the Shiré to Lake Nyasa, making Chiromo at the mouth of the Ruo our starting-point, and subsequently another line to connect Nyasa and Tanganyika. For the first project alone a sum of about £500,000 would be necessary. It seems a large sum, but we may as well look the matter in the face at once, for a few years hence the money will have to be forthcoming.

It needs no prophet to foretell that the lion's share of the work of developing Central Africa, and putting down the slave-trade, has fallen upon Britain's shoulders, and as a nation she can no more shirk her responsibility than can an individual his duty. Central Africa calls aloud for development, and I hold, with pride too, that of all nations on the face of the earth, Britain is the most fit for the work.

THE CONSTRUCTION OF A MAP OF THE WORLD ON A SCALE OF 1:1,000,000.

By Professor Dr. A. PENCK.

RECENT years have witnessed the accumulation of an enormous mass of geographical information, laid down on maps of a comparatively large scale. We have maps on a scale of 1:200,000 (3·15 miles to 1 inch) of nearly all Europe, large tracts of North America, and portions of Africa and the Indian Empire.

More than two-thirds of the whole extent of coast-line of our continents and islands are mapped on a not much smaller scale. Several of the Central and South American States, Australia, and a large portion of Western, Southern, and Eastern Asia, are mapped on scales varying between 1:500,000 (7·89 miles to 1 inch) and 1:1,000,000 (15·78 miles to 1 inch), while itineraries through the wilds of South America and Africa are now frequently laid down on larger scales than that of 1:1,000,000.

Various circumstances tend to considerably reduce the scientific and practical value of this enormous mass of accumulated information. The maps on which it is laid down are not uniform either in scale, projection, or style of execution; they are published at different places all over the world, and are often difficult to obtain. Some are only published in journals, and cannot be had separately, while others, for one reason or another, are not put in the market at all.

The circumstances and interests of our civilised life make good maps almost a necessity. Maps of our own country are absolutely indispensable; commercial interests, missionary undertakings, and colonial enterprise create a demand for maps of foreign countries, while of the maps required for educational purposes and as illustrations of contemporary history, the name is legion.

The compilation of all the existing cartographical material and its condensation into an atlas of the world, would be a work of great practical as well as scientific value, especially for nations having considerable Colonial possessions. A uniform map of the world would be at the same time a uniform map of the British Empire, showing not only the actual territory under British authority, but also the sphere of British commercial activity, and would serve the varied purposes of administration, navigation, and commerce. The desire for maps which shall show a country not merely as a piece of land limited by political boundaries, but as a region in the frame of its natural surroundings, has led to the execution not only of general maps of large portions of Central Europe by the German, French, and Austrian staffs, but also to the production of a large scale map of a whole continent—Africa.

The consideration by the Fifth International Congress (held at Berne, 1891) of the scheme for the execution of a map of the world on the scale of 1:1,000,000 (15·78 miles to 1 inch), was a step in the right direction. On that occasion the author of this paper gave a short sketch of his scheme,* which he had previously treated of in a preliminary note.† De Lannoy de Bissy, the author of the map of Africa on the scale of 1:2,000,000 (31·56 miles to 1 inch), gave his approval,‡ and after receiving the report of a committee, the Congress appointed an International Commission for the investigation of the scheme.§ Dr. Richard Lüddecke of Gotha has since started a discussion on the subject in the pages of *Ausland* ‖ in which

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* A. Penck. Die Herstellung einer einheitlichen Erdkarte im Massstabe von 1:1,000,000 (*Annales du Congrès*, Annexe IV.).

† A. Penck. Die Erdkarte im Massstabe von 1:1,000,000 (*Beilage zur Allgemeinen Zeitung*, Munich, 1891, No. 169: June 20).

A. E. Forster. Über die Herstellung einer Karte im Massstabe von 1:1,000,000 (*Das Ausland*, No. 31: 1891).

‡ De Lannoy de Bissy. Quelques détails sur la carte de l'Afrique au 2,000,000me à propos de la question de l'élaboration d'une carte de la terre à l'échelle du 1,000,000me (*Annales du Congrès*, Annexe V.). Also published separately ('Imprimerie Fricotel,' Epinal).

§ Première Résolution votée dans la séance de clôture.

‖ R. Lüddecke. Zur Erdkarte im Massstabe von 1:1,000,000 (*Ausland*, No. 46: 1891). Noch einmal zur Erdkarte im Massstabe von 1:1,000,000 (*Ausland*, No. 11: 1892).

Dr. H. Habenicht (Gotha),* Dr. E. Hammer (Stuttgart),† and the author of this paper have taken part,‡ the main points discussed being the scale and projection of the map. It will be remembered, however, that on both of these points the Congress had already expressed an opinion, the scale of 1 : 1,000,000 being approved and the division of the sheets by meridians and parallels being accepted by preference.

A comparison of the scales usually employed in the construction of general maps of extensive tracts of country will show that they range between 1 : 200,000 (3·15 miles to 1 inch), and 1 : 1,000,000. Smaller scales are but rarely employed in the construction of general maps of large portions of Europe; on the other hand, maps of European States in the best atlases rarely have larger scales than that of 1 : 1,500,000 (23·67 miles to 1 inch). In order to fulfil its purpose, so far as Europe is concerned, a map of the kind proposed must be executed on a scale not larger than 1 : 1,000,000, nor smaller than 1 : 1,500,000.

It must be confessed that for some parts of the world the scale of 1 : 1,000,000, in view of the present state of our knowledge, is much too large, but these tracts become more and more limited every year, and though twenty years ago a map of Africa on a larger scale than 1 : 5,000,000 would have seemed an impossibility, we now have a map of that continent on a scale of 1 : 2,000,000, and as long ago as 1885 the author of that great work was able to express the opinion that in ten years the scale of 1 : 1,000,000 would be the smallest on which our knowledge of Africa could be done justice to. In fact portions of Inner Africa are now mapped on the scale of 1 : 300,000, large tracts on scales ranging between 1 : 750,000 and 1 : 1,000,000, while similar scales are frequently used for route maps. It will be seen that in districts at all thickly populated from twenty to fifty place-names will go to the inch.

An advantage of the scale proposed is that it corresponds almost exactly to that of the Indian Government's 16 miles to the inch map of the Indian Empire and neighbouring countries, so that one-seventh of Asia may be said to be already mapped on this scale. Further it differs but little from the Russian military map of Russian and Turkish Asia (1 : 840,000 and 1 : 1,680,000). Moreover, the French and Dutch have given us maps of Further India and the East Indian Islands respectively, on the scale of 1 : 1,000,000, which is also used for the maps of the Transvaal and of certain Central and South American States.

It may further be mentioned that 10 per cent. of all the African maps in *Petermann's Mitteilungen* are on this scale, as also many maps published in the *Proceedings* of the Royal Geographical Society. If De Lannoy de Bissy already considers the scale of 1 : 2,000,000 too small for Africa, we may safely assume that the same is true with regard to the other continents, and that the proposed scale of 1 : 1,000,000 is in every respect the most suitable. Lüddecke has denied this, and declared that for certain parts of the earth such scales as 1 : 3,000,000 (47·34 miles to an inch) or even 1 : 4,000,000 (63·13 miles to 1 inch) would meet the requirements. The latter scale is most certainly too small. It will not allow of an adequate representation of the whole of our topographical and orographical knowledge of the earth's surface even in those districts which as yet are not fully surveyed, while in regions which are completely mapped such a scale would limit

* H. Habenicht. (*Ausland*, Nos. 1 and 19 : 1892).

† E. Hammer. Zur Projektion der Erdkarte 1 : 1,000,000 (*Ausland*, No. 40 : 1892).

‡ A. Penck. Zur Erdkarte im Massstabe von 1 : 1,000,000 (*Ausland*, No. 52 : 1891; No. 19 : 1892).

the amount of detail which could be inserted to such an extent as to materially prejudice the practical utility of the map.

A moment's consideration of existing maps of the kind will show the truth of this statement. Stieler's atlas has maps on the scale of 1:3,700,000 (58·38 miles to 1 inch) of Europe and the United States. South and Central Europe are also given on the scale of 1:1,500,000 (23·67 miles to 1 inch). The maps of countries not so favoured are very evidently too crowded. The scale of 1:3,700,000 must therefore be looked upon as distinctly too small for a map such as that proposed. Still, though for some parts of the earth even the scale of 1:2,000,000 may be too large, it must be borne in mind that the object of this scheme is to condense all our geographical knowledge, and place it upon a map which shall give a representation of the earth's surface uniform both in scale and style of execution. It appears from a paper by Mr. J. G. Bartholemew* that 56 per cent. of the land surface of the globe has already been fully surveyed, while only 12 per cent. can be described as unexplored. It is therefore apparent that only for one-eighth of the land surface of the globe could the scale of 1:1,000,000 be considered too large, while for one-half it might rather be considered too small.

During the many years that will be occupied in the execution of the map, the unexplored areas will be greatly reduced, and it would hardly seem worth while on their account to choose a smaller scale than is otherwise suitable.

Equally absurd would be the adoption of a smaller scale for these regions, as such a measure would make the map useless for purposes of measurement and comparison.

In addition to the general advantages hitherto claimed for the scale of 1:1,000,000, there is the special advantage that any metre-measure can be used as a scale for a map constructed on this scale, which, moreover, allowing for paper shrinkage is for all practical purposes identical with that of 16 miles to the inch (1:1,013,760) and 25 versts to the inch (1:1,050,000). It must be borne in mind that the sheets of this map are not intended to be joined together so as to form a map of the whole world or even of a single continent. Asia on this scale would cover 30 feet square. For such a purpose maps on a smaller scale or in a different style of execution would be needed. It might rather be described as an "Atlas of the World," the term being used in the sense in which it is applied to the large-scale maps of certain countries, the separate sheets of which no one would attempt to piece together into a map of the whole country.

This being the case there is no need for a projection such as that described by Sir Henry James (R.G.S. *Journal*, Vol. XXX., p. 106), which allows of the representation of a large extent of the earth's surface on one plane; the projection known as the polyhedric, employed for the ordnance maps of Germany, the Austro-Hungarian Empire, the United States and Japan, and the Indian Transfrontier maps, would meet the requirements. There are two methods of carrying out this projection; it can either be done separately for each section or on truncated cones corresponding to successive zones of the map. The first method produces rectilinear trapezes, and adjoining sheets of the same column or zone can be fitted together with mathematical accuracy. There is, however, a certain amount of distortion towards the edges, and the parallels of latitude do not appear as continuous curves when two sheets are fitted together. The second method gives us non-rectilinear trapezes, which can be accurately fitted together within the same zone only. The distortion is, however, considerably less, and the sheets even of different zones will fit together at least as well as paper-shrinkage allows the sheets of a map projected on to a plane to fit together.

* *Scott. Geog. Mag.*, 1890, pp. 293, 575; 1891, pp. 124, 586.

It appears that the discrepancy between the size of such a sheet and the area of the Earth's surface which it represents increases approximately with the square of its size, so that the smaller the sections, the more accurate the map. On the other hand, the larger the sections the smaller the cost of printing the whole map.

Practical considerations make a division of the map into 3° or 5° zones advisable, these being the only divisors of 90° that will give sheets of a convenient size on the scale of 1 : 1,000,000. Even the inaccuracy in 5° sections is not as great as that caused by paper-shrinkage. For all practical purposes then we may look upon the projection of the map on 3° or 5° sections as mathematically accurate. There is no need for an equivalent projection of each separate section. This would produce curved meridians, and render the joining together of sheets within the same zone impossible.

Towards the poles the longitudinal extent of the sections is, of course, reduced. On the parallel of 60° it is but half of what it was on the Equator. It would seem advisable then to divide the zones between the poles and 60° into half as many columns as between 60° and the Equator. This would make it possible to have the sheets of the map as nearly as possible of equal size, without making a change in their division, which would complicate the numbering of the sheets. Several considerations point to a division of the map into 5° sections as in every respect the most suitable. Both the single-column sheets between the Equator and 60° and the double-column sheets between 60° and the pole will be found to have a handy size, while for purposes of numeration a division which adapts itself to the decimal system is certainly the best.

Dr. Lüddecke mentions as one of the greatest drawbacks of the polyhedric projection the impossibility of fitting any number of sheets together. We have already seen that it allows adjoining sheets of the same zone to be fitted together with mathematical accuracy. Owing to the difference between the radii of the parallels of latitude it will be seen that if sheets of different zones are grouped symmetrically on either side of a meridian, there is a gap between adjoining zones, which increases by geometrical progression with every column's distance from the central meridian. These inaccuracies, however, are for adjoining sheets not greater than those caused by paper-shrinkage; and when we consider that it cannot possibly serve any practical purpose to fit more than nine sheets together, we may safely disregard this objection of Dr. Lüddecke's. Nine sheets of the map would cover a surface of nearly 6 feet square, about as large an extent as can be conveniently overlooked, and even in this case the greatest extent of the gap between the sheets would not be more than $\frac{1}{5}$ of an inch. This refers to sections near the equator; nearer the poles the gaps are even smaller. The widespread use of the Greenwich meridian makes its adoption in the construction of this map seem advisable. De Lannoy de Bissy recommends the subsidiary insertion of longitudes counted from other meridians.

Sea, rivers, and lakes should be shown in blue; the map should contain as much information as possible regarding tides, variations in the extent of lakes, sea-depths, swamps, &c.

In order to give a really satisfactory representation of the relief of the earth's surface, the map should show both the absolute and the relative elevation. This can really only be done satisfactorily by a combination of contours with colouring, either as hypsographical surface colouring varying with the elevation, or as shading to show steepness. Either of these methods has some disadvantages; and the best plan would, therefore, seem to be a combination of both: the relative elevation being shown by hachures, and the absolute elevation by the insertion of a limited number of contours in conjunction with hypsographical surface colouring.

Four contours would seem to suffice, drawn at 100 (328 feet), 300 (984 feet),

500 (1640 feet), and 1200 (3937 feet), mètres elevation. They would only be inserted where our knowledge enables us to do so with accuracy; elsewhere the elevation would be vaguely indicated by the hypsographical colouring.

Known elevations should be inserted. The foot, which is used by practically one-third of the human race is too small, the mètre being much handier; no elevations would require to be written in more than four figures, and there is the advantage of the decimal system. A further saving of space might be made by the adoption of the decamètre (32·81 feet) in view of the fact that only in those countries which have been completely mapped, is it possible to give elevations correct to a mètre, so that the elevations would need only three figures.

The boundaries of States should be shown in black, perhaps edged with a narrow strip of colour. The boundaries of minor political divisions, such as French departments and English counties, may be omitted. All railways, the more important roads, lines of telegraph, the limits of navigation on rivers, should be shown. The scale of the map will not allow an indication of the relative extent of forest, arable land, and pasture, but an indication of at least the first of these might be possible.

In fully surveyed and thickly populated districts a judicious selection will have to be made of the towns and villages to be inserted. As much information as possible relating to means of communication by land or water should be given, railway-stations and harbours indicated, and notable centres of any special industry marked as such. In partially explored regions all known place-names should be inserted, a distinction being drawn between permanent and temporary habitations.

The question of spelling is one of the most difficult connected with the map. The fact that different nations pronounce the same letter differently would seem to make a uniform system of *phonetic* spelling desirable; but this is impossible for obvious reasons.

The principle to be adopted may be shortly stated as follows: The Latin alphabet alone should be used; and for each country together with its colonies and sphere of influence, the official spelling should be adopted. In some cases, as when more than one language is spoken within one State, the unofficial form of the name could be inserted in brackets, *e.g.*, Bruxelles (Brussels), Lemberg (Lwów), Derpt (Dorpat). For countries in which the Latin alphabet is not used, the place-names should be transliterated. In the case of certain countries (*e.g.* Russia) it might be possible to issue a special edition with the original lettering. The lettering would then have to be on a separate stone.

The number of stones required for the printing of one sheet would be six:

(1) Water	Blue.
(2) Hills	Brown.
(3), (4), and (5) Hypsography	3 colours.
(6) Outline and lettering	Black.

This number might be reduced by such expedients as the combination of (1), and (6), or the insertion of figures showing heights above sea-level in place of the hypsographical colouring. This however is not advisable.

If the sections of the map are made to correspond with 5° trapezes, they will number 880. If between the parallels of 60° and the poles the sections are made to include 5° of latitude by 10° of longitude, the total number will be 769. It will be found advisable to extend a certain number of sheets (49) longitudinally, so as to include small tracts of land which it would not be worth while to represent on separate sheets. In twenty-seven cases an extension latitudinally will be found convenient.

The few isolated islands which do not find a place on one or other of the sections may be shown on insets.

Each section is indicated by the numbers of the zone and column to which it belongs, and moreover bears the name of the principal town or some important physical feature; for example, sheet New York, Zone IX. N., Column 15 W. Each sheet must bear scales of the measures in use in the region to which it refers, and the date of its publication, and must indicate the system of spelling adopted. Sections representing countries which are fully explored may well be engraved on copper, while for others lithography should be employed.

Certain sets of sections should be accompanied by explanatory memoirs. These would contain:—

1. An account of material used in the compilation of the map.
2. An index of place-names, giving their geographical position.

The complete map will cover an area of 2127 square feet. The cost of production may be set at about £9 per square foot for an edition of 1,000 copies. If the whole edition were sold at 2s. a sheet, there would be a deficit of over £100,000. This is a large sum, but larger sums have been spent ere now on scientific objects, instance the expenditure on Arctic exploration in the forties and fifties and on African exploration more recently. We may also mention the expenditure of a sum equal to the above-mentioned deficit for a year's meteorological observation in the Arctic regions; further that in consequence of a vote of the International Astronomical Congress at Paris (1887), the execution of a complete map of the heavens on an even larger scale than that of the proposed map of the earth has been undertaken.

The following table will show the number of sheets which will fall to the share of each country:—

British Empire (Including 57 double-column sheets)	222	German Empire	21
Russia (Including 100 double-column sheets)	192	Turkey	18
United States (Including 12 double-column sheets)	65	Spain	16
France	55	Argentine Republic	15
Scandinavia (Including 51 double-column sheets, 12 sheets go to the interior of Greenland.)	54	Mexico	13
China	45	Italy	10
Brazil	28	Japan	10
Egypt and North Africa	27	Portugal	8
Netherlands	24	Congo State	8
Venezuela, Colombia, Ecuador, Peru, and Bolivia	22	Austria-Hungary	7
		Chile	7
		Central American States	6
		Persia	4
		Belgium	1
		Switzerland	1
		Greece	1
		Islands	3

More than three-quarters of the whole number of sheets thus fall to the share of ten States. If these countries give their approval to the scheme, its success will be assured, even if in some cases the work has to be done by private individuals or at the expense of geographical societies instead of by Government.

The International Commission is pledged to the careful consideration of all points bearing on the scientific and practical utility of the map and the feasibility of the scheme. Their labour may be materially lightened if they are accorded assistance, by scientific and practical geographers, in the form of suggestions and criticism. The execution of a map of any region in the manner described above would be a valuable experiment.

DIMENSIONS OF 5° TRAPEZEZOIDS ON THE SCALE OF 1 : 1,000,000, AND ELEMENTS FOR THEIR CONSTRUCTION.

Zones.	Length of the Parallels of Latitude Limiting the Sheets.	Length of the Central Meridian.	Area of the Earth's Surface represented by one Sheet. (to scale.)	Area of the Sheet.	Difference.
	millimètres.	millimètres.	sq. millimètres.	sq. millimètres.	sq. millims.
Zone I.	$(P_0 = 556{,}5)$	$m_1 = 552{,}8$	$F_1 = 307282$	$B_1 = 307088$	$D_1 = 194$
,, II.	$(P_1 = 554{,}4)$	$m_2 = 552{,}9$	$F_2 = 305004$	$B_2 = 304812$	$D_2 = 192$
,, III.	$(P_2 = 548{,}1)$	$m_3 = 553{,}1$	$F_3 = 300463$	$B_3 = 300274$	$D_3 = 189$
,, IV.	$(P_3 = 537{,}7)$	$m_4 = 553{,}3$	$F_4 = 293685$	$B_4 = 293500$	$D_4 = 185$
,, V.	$(P_4 = 523{,}2)$	$m_5 = 553{,}6$	$F_5 = 284709$	$B_5 = 284530$	$D_5 = 179$
,, VI.	$(P_5 = 504{,}7)$	$m_6 = 554{,}0$	$F_6 = 273591$	$B_6 = 273419$	$D_6 = 172$
,, VII.	$(P_6 = 482{,}4)$	$m_7 = 554{,}4$	$F_7 = 260399$	$B_7 = 260234$	$D_7 = 165$
,, VIII.	$(P_7 = 456{,}4)$	$m_8 = 554{,}9$	$F_8 = 245217$	$B_8 = 245062$	$D_8 = 155$
,, IX.	$(P_8 = 426{,}9)$	$m_9 = 555{,}4$	$F_9 = 228146$	$B_9 = 228002$	$D_9 = 144$
,, X.	$(P_9 = 394{,}2)$	$m_{10} = 555{,}8$	$F_{10} = 209301$	$B_{10} = 209169$	$D_{10} = 132$
,, XI.	$(P_{10} = 358{,}4)$	$m_{11} = 556{,}3$	$F_{11} = 188814$	$B_{11} = 188694$	$D_{11} = 120$
,, XII.	$(P_{11} = 319{,}9)$	$m_{12} = 556{,}8$	$F_{12} = 166832$	$B_{12} = 166726$	$D_{12} = 106$
,, XIII.	$(P_{12} = 279{,}0)$	$m_{13} = 557{,}2$	$F_{13} = 143518$	$B_{13} = 143427$	$D_{13} = 91$
,, XIV.	$(P_{13} = 235{,}8)$	$m_{14} = 557{,}6$	$F_{14} = 119050$	$B_{14} = 118977$	$D_{14} = 73$
,, XV.	$(P_{14} = 190{,}9)$	$m_{15} = 557{,}9$	$F_{15} = 93617$	$B_{15} = 93558$	$D_{15} = 59$
,, XVI.	$(P_{15} = 144{,}5)$	$m_{16} = 558{,}1$	$F_{16} = 67423$	$B_{16} = 67380$	$D_{16} = 43$
,, XVII.	$(P_{16} = 97{,}0)$	$m_{17} = 558{,}3$	$F_{17} = 40676$	$B_{17} = 40650$	$D_{17} = 26$
,, XVIII.	$(P_{17} = 48{,}7)$	$m_{18} = 558{,}4$	$F_{18} = 13596$	$B_{18} = 13587$	$D_{18} = 9$
	$(P_{18} = 0{,}0)$				

Radii of the Parallels.	Half Chords of the Parallels.	Distance of the Chords from the Parallels.
millimètres.	millimètres.	millimètres.
$R_0 = 146231$	$S_0 = 278{,}3$	$T_0 = 0{,}27$
$r_1 = 145678$	$s_1 = 277{,}2$	$t_1 = 0{,}26$
$R_1 = 48690{,}1$	$S_1 = 277{,}2$	$T_1 = 0{,}79$
$r_2 = 48137{,}2$	$s_2 = 274{,}1$	$t_2 = 0{,}78$
$R_2 = 29027{,}4$	$S_2 = 274{,}1$	$T_2 = 1{,}29$
$r_3 = 28474{,}3$	$s_3 = 268{,}8$	$t_3 = 1{,}27$
$R_3 = 20498{,}5$	$S_3 = 268{,}8$	$T_3 = 1{,}76$
$r_4 = 19945{,}1$	$s_4 = 261{,}6$	$t_4 = 1{,}71$
$R_4 = 15671{,}8$	$S_4 = 261{,}6$	$T_4 = 2{,}18$
$r_5 = 15118{,}2$	$s_5 = 252{,}3$	$t_5 = 2{,}10$
$R_5 = 12528{,}0$	$S_5 = 252{,}3$	$T_5 = 2{,}54$
$r_6 = 11974{,}0$	$s_6 = 241{,}2$	$t_6 = 2{,}43$
$R_6 = 10290{,}8$	$S_6 = 241{,}2$	$T_6 = 2{,}83$
$r_7 = 9736{,}4$	$s_7 = 228{,}2$	$t_7 = 2{,}67$

Radii of the Parallels.	Half Chords of the Parallels.	Distances of the Chords from the Parallels.
millimètres.	millimètres.	millimètres.
$R_7 = 8593{,}7$	$S_7 = 228{,}2$	$T_7 = 3{,}03$
$r_8 = 8038{,}8$	$s_8 = 213{,}4$	$t_8 = 2{,}83$
$R_8 = 7243{,}4$	$S_8 = 213{,}4$	$T_8 = 3{,}14$
$r_9 = 6688{,}0$	$s_9 = 197{,}0$	$t_9 = 2{,}90$
$R_9 = 6128{,}8$	$S_9 = 197{,}0$	$T_9 = 3{,}17$
$r_{10} = 5572{,}9$	$s_{10} = 179{,}2$	$t_{10} = 2{,}88$
$R_{10} = 5178{,}8$	$S_{10} = 179{,}2$	$T_{10} = 3{,}10$
$r_{11} = 4622{,}5$	$s_{11} = 159{,}9$	$t_{11} = 2{,}77$
$R_{11} = 4318{,}2$	$S_{11} = 159{,}9$	$T_{11} = 2{,}94$
$r_{12} = 3791{,}5$	$s_{12} = 139{,}4$	$t_{12} = 2{,}57$
$R_{12} = 3605{,}1$	$S_{12} = 139{,}4$	$T_{12} = 2{,}70$
$r_{13} = 3047{,}9$	$s_{13} = 117{,}9$	$t_{13} = 2{,}28$
$R_{13} = 2926{,}4$	$S_{13} = 117{,}9$	$T_{13} = 2{,}38$
$r_{14} = 2368{,}8$	$s_{14} = 95{,}4$	$t_{14} = 1{,}92$
$R_{14} = 2294{,}6$	$S_{14} = 95{,}4$	$T_{14} = 1{,}99$
$r_{15} = 1736{,}7$	$s_{15} = 72{,}2$	$t_{15} = 1{,}50$
$R_{15} = 1696{,}5$	$S_{15} = 72{,}2$	$T_{15} = 1{,}54$
$r_{16} = 1138{,}5$	$s_{16} = 48{,}5$	$t_{16} = 1{,}03$
$R_{16} = 1121{,}0$	$S_{16} = 48{,}5$	$T_{16} = 1{,}05$
$r_{17} = 562{,}7$	$s_{17} = 24{,}3$	$t_{17} = 0{,}52$
$R_{17} = 558{,}4$	$S_{17} = 24{,}3$	$T_{17} = 0{,}53$
$r_{18} = 0{,}0$	$s_{18} = 0{,}0$	$t_{18} = 0{,}00$

THE MONTHLY RECORD.

THE SOCIETY.

Mr. Conway's Expedition to the Karakoram.—Mr. Conway has returned from his expedition to the Karakoram with abundant and valuable results in the shape of diaries, maps, photographs, sketches (by Mr. A. D. McCormick), and collections of various kinds. The maps will be published by the Society, and Mr. Conway hopes to give an account of the work of the expedition at the meeting of the Society on May 8th.

Educational Lectures.—The Friday evening lectures on "The Relations of Geography to History in Europe and Asia," by Mr. H. J. Mackinder, continue to be well attended. The four concluding lectures will be given in March, the subjects being—"The Alps as a Factor in European History," "The Approaches to Italy," "The Division of Gaul," "Some Geographical Analyses of British History." It is hoped that in the April or May number of *The Geographical Journal*, a report in abstract of the whole series will be given, accompanied by diagrams. A revised edition of the lectures will be ultimately published in book form.

Bibliography of Morocco.—The last Supplementary Paper which has been issued, and is now ready to be delivered to Fellows on application at the Office, is singularly appropriate in its date of publication coinciding with the fresh interest taken in Moorish affairs in this country. It takes the form of an exhaustive Bibliography of Morocco, compiled by Sir Lambert Playfair and Dr. Robert Brown, and is the fourth part of the Bibliography of the Barbary States. The references have a wide range in time, the first entry being the work of Hecatæus in B.C. 520; the last, No. 2062, a speech by the Marquess of Salisbury, reported in a daily paper of 1891. Besides these chronologically arranged entries there are one hundred and eighty-one references to papers in public records. Probably no work of any importance whatever down to the end of 1891 is omitted, and the bibliography is valuable not only as a convenient catalogue for reference but as a historical summary full of interesting biographical touches regarding early writers and explorers.

EUROPE.

Mr. Grundy's Surveys in Boeotia.—Geography touches at many points both History and Literature. The narratives of ancient historians have often been needlessly taxed with obscurity or incorrectness because large-scale contoured maps have not been procurable, and critics have been wanting in local knowledge or topographical faculty. In Italy the new survey (1:25,000) will probably do more than many volumes to elucidate classical sites and battlefields. In Greece, maps of this character have still to be produced by private enterprise. In Attica, Germany has done good cartographic work. Our Council recommended Mr. G. B. Grundy, of Brasenose College, the Student in Geography appointed by the Society and the University of Oxford jointly at the beginning of 1892, to give his attention to Boeotia. He has lately spent some weeks in that country in surveying the battlefields of Plataea and Leuctra and also the ruins remaining on the site of the town of Plataea itself. The weather, during almost the whole time he was in the country, was, unfortunately, very unfavourable for survey work, and he was obliged to give up his intention of mapping out the fields of Coronea, Chaeronea, and Orchomenus, and had time allowed it, that of Delium. The field of Plataea also involved far more work than he had expected, owing to the extreme irregularity of the ground, and the extent of it. The map he has made includes an area of 14 square miles, and is drawn on a scale of 8 inches to the mile. Midwinter is hardly an ideal time for survey work, but the circumstances of Greece generally, and Boeotia in particular, practically necessitate the carrying out of the work at this period of the year. It is only at this season that the ground is free from crops, and it is hardly likely that even the most patient husband-

men would submit without some expression of feeling on the subject to having their vines and corn trampled upon by a foreign intruder when the former are in leaf and the latter above ground. The special circumstance which applies to Boeotia is the danger of malaria in the region of Lake Copais, where it is peculiarly prevalent in the summer months. Mr. Grundy has good reason to know that immunity from this risk is not to be guaranteed even in the cold weather. The monograph, or monographs, in connection with the maps will require some little time to prepare, since in the cases at least of the battlefield and town of Plataea, it has been necessary to touch on much debated questions. The peculiar interest which attaches to the questions that relate to the field and the site respectively of Plataea, is due to the fact that modern commentators whose very names inspire respect, have considered it impossible to reconcile the evidence which is attainable on the ground at the present time with the accounts of events related in detail by Herodotus and Thucydides as having taken place on that ground. It has been Mr. Grundy's endeavour to throw some light on these disputed questions by taking such a survey of the areas as would possibly contribute to at any rate a clearer understanding of the points which have been urged in the above-mentioned commentaries. It will be seen, then, that the work which has been done by the Society's student is a contribution towards the solution of a much more important question than is involved in the determining of the position of a body of men on a certain battlefield, or the location of the site of a possibly unimportant building. These minor questions may interest the specialist student of ancient history, but the major question involving the credibility of Herodotus and Thucydides must appeal to the interest of any one who has studied ancient history at all. Mr. Grundy has studied the classical narratives among the actual scenes in which the events narrated are represented as having taken place, and his monographs will aim at a statement of the impressions which he has formed in consequence of such study, while the accurate and minutely detailed surveys which he has made will give critics for the first time the advantage of an adequate knowledge of local facts on which to form their opinions.

The Torrents of Switzerland.—Our honorary corresponding member, Professor Paul Chaix, of Geneva, in sending the volume to which he refers, writes as follows:—"I have in a former paper given an abridged account of the general measures adopted to prevent or remedy the floods to which Switzerland is liable by constructing weirs on a certain plan at the head of some of the mountain streams. The engineer, M. Ad. de Salis, lately deceased, left a second report ready for press, describing some new works executed in ten different parts of the country. It has now been published, illustrated by twelve maps, twenty-one photograph

views, very finely reproduced, and thirty-three plates. The most important of these works is the controlling of the Nolla, a small stream but peculiarly dangerous on account of the floods it has occasioned in a large part of the Canton of Grisons. The Schwarz Nolla, so called on account of its turbid waters, enters the bed of the Hinterrhein by its left bank, opposite the venerable ruins of the castle of Hohenrhätien, and above the borough of Thusis. The Schwarz Nolla, falling from a height of 6056 feet above the level of the sea to that of 3696 feet in a distance of 2 miles within a narrow chasm lined with very steep crumbling sides, carried, when swollen by unusually heavy rains, formidable volumes of mud which stopped the course of the Rhine, and for days together subjected the whole country to disastrous floods. These inundations are recorded as serious in chronicles of the year 1585, and were repeated in 1705, 1706, 1707, 1710, 1711, and 1719. An inundation in 1807 led to the interference of the renowned Escher, the engineer of the Linth. The year 1868 was the occasion of a succession of repeated disasters, which it required energetic steps to resist; and they, like the others, originated with the filling up and sudden discharge of the chasm of the Schwarz Nolla. All the tributary rills which run on the left slopes of its course were stopped above the chasm, diverted into an artificial canal, the slope of which was regulated by a succession of twenty-seven weirs, and restored at a lower level to their original course, so clear and free from mud as to prove completely harmless when the extraordinary rains of the year 1890 poured disastrous floods over the Austrian territory on the right bank of the Rhine. The precise nature of the works executed on each of the streams, with large-scale plans and sections, is described in the memoir."

The New Survey of France.—A paper read to the French Topographical Society by M. Ch. Lallemand, the Chief of the Levelling Service, and published in the *Revue de Géographie*, for January and February, gives a masterly summary of the methods and results of the great work which has just been completed. The levelling was of a very high order of precision, and the accumulated error between Marseilles and Lille could not exceed 2 inches. The mean level of the sea was obtained, by the use of specially constructed recording tide-gauges, at more than forty stations on the Channel, the Bay of Biscay, and the Mediterranean. The result of these determinations, connected by the land levels, showed that there was no appreciable difference in the mean level of the sea on the three coasts of France, the greatest observed differences being only a few centimetres. Suitable bench-marks are now being put in position all over the country, and a complete index of these, specifying the exact elevation, will shortly be published.

Local Geography in France.—The extent to which local geographical study is organised and encouraged in France contrasts curiously with

the almost exclusive interest in foreign countries which sums up all geography in the average British mind. *La Geographie* publishes a syllabus of the Geographical Section of the Congress of Learned Societies which opens in the Sorbonne on April 4th, and it may be of service to the much-neglected local geography of the United Kingdom if we summarise its main features. These are: To report the existence of the more interesting geographical manuscripts and maps preserved in the various public libraries or private collections in France, and to catalogue early local maps; to determine the boundaries of one or more of the old provinces of 1789, to give biographies of early French explorers, and their work previous to 1789; to trace the actual distribution of dwellings in France, *e.g.*, the mode of grouping into farms, hamlets, villages, towns, etc., in different parts of the country with the greatest altitude at which houses are permanently occupied, and similar studies for earlier periods. Research into the limits of the most characteristic ethnic suffixes in place-names illustrated by maps; the study of the boundaries of the old local divisions such as Brie, Beauce, Morvan, Sologne, as shown by the customs, dialects, and characteristics of the people, and the physical causes which have determined these divisions; the recovery of popular names for natural features which are not preserved on official maps. It is intended also to study the past and present changes in the coast-line caused by erosion, sand-drift, etc., to seek for evidence of movements of the land in inland places within historic time or in human memory, and to give a detailed account of all traceable physical changes carried back to the earliest times for some one region; to investigate the traces of the earliest peoples in France, especially in Brittany, and to study colonial geography. Such a programme is, we fear, too ambitious to be successfully fulfilled; but many entries in our monthly record of geographical literature show how effectively the geography—as distinguished from the topography—of small districts is now being studied by the French.

The Basin of Arcachon, Gironde.—M. J. Thoulet gives, in the *Comptes Rendus*, a note on this basin—a large depression communicating with the ocean only by a narrow channel, and separated elsewhere by sand-dunes. This is the chief centre in France for the culture of oysters. Its bed (mostly covered at high water) is traversed by channels of various depths, due to the violent currents, which play an important part in moulding its features. These vary in speed and direction, according to the state of the tide and the variable amounts of water which enter or leave the basin in equal times. The sand-dunes fringing its shores are much subject to erosion, which is most active where the currents impinge on a concave shore, especially when this is the case both at the flood and ebb. The basin is being rapidly filled with sediment; and unless recourse is had to dredging—a *desideratum* both for the sake of the oyster-beds and the improvement of the neigh-

bouring lands for agriculture—it is likely to share the fate of the other basins of the Landes, now shut off from the sea, whose mode of origin is elucidated by a study of that of Arcachon. In the sand-dunes five superposed beds of soil are to be traced, containing trunks of trees *in situ* and other remains of vegetation.

ASIA.

The Trans-Caspian Province.—A correspondent in Askhabad points out that in the statistics of the Trans-Caspian Territory in the *Proceedings* for 1892, p. 858, the number of strangers in 1890 should be 19,227 instead of 9227 as there given. He also sends some interesting statistics for the year 1891. The total population in that year was 276,709, of whom 210,518 were Turkomans and 44,404 Kirghiz, a total of 254,922 indigenous people (62,008 kibitkas), and 21,787 strangers, of whom 6762 were Russians (troops excluded). During 1891 the sources of the Ghermal River have been cleared out and the water led into artificial canals. The daily supply of water is thus increased by 100,000,000 gallons, and it has been possible without detracting from the value of existing Russian and Turkoman villages, to found two new settlements—Skobelevski and Kulkulab. The irrigation of the Merv, Tolstan, and Penjdeh oases has been greatly improved, and new military cantonments for the protection of Russian colonists have been founded on the Kushk River in the neighbourhood of Kota Tepe, and joined by telegraph and carriage-roads to Merv and Sarakhs.

Mr. E. H. Parker's Report on Annam.—Consul Parker in his recent report on Annam gives some useful notes regarding the present condition of the country. The north and south "dominions" of Annam are the real present centres of wealth and population, whilst Annam proper is described as a mere strip, like Chile, wedged in between the mountains and the sea, with a population of about four or five millions. Tonkin, the ancient seat of the Annamese race, has a population of from fifteen to twenty millions. The combined population of Cambodia and French Cochin China apparently does not exceed that of Annam proper. French Cochin China is that part of Cambodia conquered by Annam in 1699, and colonised with Chinese and Annamese. Whilst at Turane, the great trading port of Annam, an opportunity was afforded Consul Parker of visiting the coal mines at Nong-sin, situated in the mountains which practically form a western boundary for all Annam, and lying about 40 miles to the south-west of Turane. The concession now being worked is about 4 square miles in area, inclosed on three sides by mountains, and on one by the river. The coal, of which there appears to be abundance, is chiefly anthracite. On the way to the coal-mines, Consul Parker visited the citadel of Kwang-nam and the ancient mart of Faifo. Kwang-nam, we are told, is the capital of the province of the same name, which with the province

of Kwang-ngai, forms the residency of Nam-ngai. The citadel is described as a square enclosure, about a mile in circumference, surrounded by a moat, and guarded at each corner by a bastion; though smaller, it apparently differs little in general style from the citadels of Hué and Hanoi. Faifo, although a great trading centre in the sixteenth century, is now described as being a mere link or depôt for the transit of inland goods from the semi-civilised regions. Its chief exports are sugar, silk, cinnamon, and edible birds'-nests. Consul Parker is of opinion that under a watchful customs administration, the trade of Annam would be capable of great development.

Survey of the River Sebong (Annam).—An excellent piece of survey work was accomplished last year by Dr. A. Yersin, in the course of a journey from the coast of Annam to the Mekong, across a hitherto unknown tract of country. Dr. Yersin is an official of the "Compagnie des Messageries Maritimes," and the general plan of his journey, which was made during a short leave of absence, was suggested to him by Captain Cupel. The principal object was to discover the source of the Sebong, one of the great affluents of the Mekong, and, if possible, the headwaters of the Don Nai. The first part of the programme only could, from lack of time, be carried out, as the basins of the Sebong and the Don Nai are separated by a high range of mountains, which can only be crossed during the dry season, and the traveller was too late (June). The country traversed is inhabited by numerous savage peoples (the Mois, the Benongs, etc.) who have no relations with the Annamites, and had never seen or heard of Europeans. They are extremely warlike, and have no central government, each village forming a little independent republic, always at war with its neighbours. Dr. Yersin travelled alone, with two Annamite boys, and was well received everywhere. The country is a plateau, rising to about 1500 feet above the sea-level, and cut by numerous water-courses. It is covered by an immense forest, extending from the coast of Annam to the Mekong. This forest contains in some parts gigantic trees, on which many varieties of orchids flourish, and is peopled by animals of every description, *e.g.*, elephants, rhinoceroses, wild buffaloes, tigers, deer, bears, boars, monkeys. In certain districts the population is very dense, a village of from one hundred to four hundred inhabitants occurring every 8 miles; in other parts the country is absolutely desert. Sometimes the traveller marched for seven whole days without coming across a single habitation. The geographical co-ordinates of all the villages were taken by means of a theodolite, and it has thus been possible to prepare an accurate map of the region, showing the whole course of the river Sebong, from its source to its confluence with the Mekong. This map, with a brief résumé of the expedition, appears in Nos. 15 and 16 of the *Comptes Rendus* of the Paris Geographical Society; the detailed report will be published in the work of M. Pavie, on the operations of his mission in Indo-China.

Meteorology of the Pamirs.—The *Bulletin* of the Paris Geographical Society (1892, p. 316) contains notes by M. Capus on the climate of the Pamirs. Summer in that region, or the period in which no frosts occur, occupies two, or at most three, weeks in July. Spring and autumn last each slightly over two months, and winter prevails for the remaining seven. M. Capus's observations were taken in March and April, 1887. A remarkable fact is the non-persistence of very low temperatures even in winter. The variations between day and night, sun and shade, are excessive, and the rise and fall of the thermometer very rapid. Although by night, especially if calm and cloudless, the freezing-point of mercury will often be reached, between midday and one P.M. the temperature will be above 32° Fahr., being higher with a cloudy sky. In spring south-west winds prevail, blowing from the plains up the main valleys, following their trend. Another noteworthy point is the uneven distribution of snow, which depends on the degree of exposure to wind, aspect of slopes, altitude, soil, &c. The Pamirs proper have a much slighter snow-covering than the Alai, the wind having deposited most of the moisture on the bounding ranges. Many parts are bare even in winter, and afford scanty pasturage. The considerable amount of radiant heat absorbed by dark soils contributes to the quick melting of the snow. Glaciers now hardly exist, and the drainage is much less than formerly, probably owing to the desiccation of the Central Asian depressions.

Present Condition of Bussorah. — Major Jennings, in a recent consular report, gives an account of the present condition of Bussorah. This town is situated on the right bank of the Shat-ul-Arab, some 60 miles from its mouth at Fao, at the head of the Persian Gulf. There is deep water between Bussorah and the latter place, excepting a slight bar at Muhammarah (18 miles below Bussorah). The second bar is situated a couple of miles from the mouth of the river, on the right bank, and 2½ miles east-south-east of Fao Fort. The depth of the water on the bars is much influenced by local conditions, being greater with a southerly wind. The exports of Bussorah include dates, wool, and horses, the majority of the latter coming from the Montefik and Amarah country, while, as a rule, the more valuable horses come from Mosul and Najd. Agriculture has apparently not developed much of late years in the immediate vicinity of Bussorah, owing to the fact that almost all available and suitable land is being devoted to the cultivation of the date-palm. Referring to the climate of Bussorah, Major Jennings says: "It is true that a remarkable improvement has taken place in the neighbourhood, owing to the substitution of date and wheat cultivation for that of rice, the result being that the river banks are all along now 'bunded' to keep out the water, except that necessary for irrigation purposes, and the

country inland is hence much drier than heretofore. But malarial fever has by no means vanished." Of late years Bussorah has become a large grain-exporting port; and the exports of cereals (wheat, barley, rice, &c.) during the past year (1891) have far exceeded in amount those of any previous year.

The Coal-Measures of Sakhalin.—It appears from the explorations which were made in 1891 by the mining engineer, M. Sukhanevich, in Aniva Bay, on the east coast of the Island of Sakhalin, in the neighbourhood of Korsakoff Station, that the best beds of coal in these regions are found about Selutor Station and on the River Nai. Two beds of coal, the maximum thickness of which is respectively 9 and 23 feet, and accompanied by two thinner beds, were found around Selutor Station. The coal is embedded in soft clay, shale, and sandstone. Iron ore has been found in many places, but only in lumps scattered within the rocks.

AFRICA.

Mr. Chanler's Expedition in East Africa.*—Mr. Chanler left Mkonumbi on the coast of Witu on September 18th with a caravan numbering 185 men, 15 camels, 43 donkeys, 2 horses, 10 oxen, and 10 goats, and reached Hameya (or rather Balarti, the I. B. E. A. Co.'s station) on November 26th, with a loss of 20 men and 5 camels. He marched in a leisurely manner, following the left bank of the Tana from Merifano to Subaki, where he crossed over to the right bank. A small flotilla of twelve canoes carried food and some of the loads. An ordinary trading caravan might do the distance in five weeks. He found the Tana route a capital one for caravans. There is plenty of food from Engatana on, and there is no difficulty in procuring water if one takes native guides. The Wapokomo dreaded the approach of Europeans, but Mr. Chanler did his best to remove the bad impression former travellers have left behind them, and succeeded in establishing friendly relations. At Tuni he succeeded in driving off a party of Somalis, who were ravaging the neighbourhood. The Gallas of Korokoro were found to be in a very weak state, having been attacked three times this year by the Wakamba. The Company's station was found to be in good repair. Careful search was made for the "Galla" and "Friedrich Franz Mountains" of Dr. Peters; but they could not be found. Mr. Chanler proposes to march with Lieutenant von Höhnel and seventy-five men to the Mackenzie River, to follow that river up to its source, and to go in search of the Lorian Lake. He expects to return to his depot at the Company's station in about a couple of months. Lieutenant von Höhnel's map of

* Communicated by the Imperial British East Africa Company.

the Tana agrees with those of Mr. Denhard and Captain Dundas, as to details,* but shifts the whole of the river from 18 to 28 miles to the east. The principal points determined astronomically by Lieutenant von Höhnel are the following—

	Lat. S.			Long. E.		
	°	′	″	°	′	″
Mkonumbi	2	18	40	40	43	50
Witu Camp	2	26	40	40	30	52
Merifano	2	16	15	40	15	30
Engatana Camp	2	13	31	40	19	0
Mwina Camp	2	3	40	40	21	40
Kinakombe Camp	1	45	23	40	18	30
Massa Village	1	12	13	40	11	53
Tuni Camp	1	4	35	40	10	0
Company's Station (Balarti)	0	7	23	39	25	0

The Sabi River.—Mr. A. Vaughan Williams writes from Chiloane, October 3rd, 1892, that he has ascended the Sabi River to the furthest point where the tide is felt, or about 30 miles from its mouth. He entered by the northern or Makau branch of the Sabi, which has a bar with 5 feet of water at low tide, and is about half a mile wide. Spikuku's people, whose Zimbabwe he visited, speak the same language as the Banyai. They have fought valiantly against the invading Zulu, and the jungle, in which they occasionally sought a refuge, is strewn with human skeletons. The indiarubber plant abounds in this jungle. There people spin their own cotton and make nets, but they have no looms. Mr. Williams returned to Chiloane by an inland passage, which branches off from the Makau, and is navigable for small boats. He now proposes to make a careful examination of some ruins recently discovered by him on the Buzi.

Zimbabwe Ruins.—We are pleased to observe in the cyclostyled newspaper of Tuli, *The Rhodesia Chronicle and Mashonaland Advertiser*, of December 24th, the following official advertisement:—"Notice is hereby given that the Zimbabye Ruins and the space within a radius of one mile from the top of the Zimbabye Hill is preserved by the Government solely for archæological and scientific purposes, and that no farmers, squatters, or other persons, will be allowed to reside herein; and further that no ploughing or excavating for private purposes will be permitted within such radius. Any person infringing the notice will be regarded as a trespasser, and be liable to prosecution."

Major von Wissmann's Steamer.—In 1890 the Committee of the Anti-Slavery Lottery Fund undertook to transport three steamers to the

* See this map in *Proceedings*, Royal Geographical Society, for August 1892, with notes on it, *ib.* p. 530.

African lakes; the *Peters* to the Victoria Nyanza, the *Wissmann* to Lake Tanganyika, and the *Pfeil* to Lake Nyasa. The public had subscribed £14,400 towards the cost of these steamers, whilst £30,000 were voted by the Fund. The disturbances in Eastern Africa prevented the conveyance of the *Peters* to its destination, and this boat now does duty on the coast. Major von Wissmann's Expedition, consisting of twenty-three Europeans and two hundred and thirty natives, arrived at the Chinde mouth of the Zambezi about the middle of June, together with the steamers, three steel boats, and four barges. The first detachment of the expedition started on July 14th. The difficulties of transport, however, proved so formidable that the original plan has been given up. The *Pfeil*, a screw-steamer 52 feet in length, is to return to the coast, whilst the *Wissmann* is to be put together at Mpimbe on the Upper Shire, and will do duty on Lake Nyasa. The *Wissmann* is a steel boat constructed in six compartments. Her total length is 85 feet, she has a draught of about 6 feet, and engines of 120 horse-power.

Lagos.—The Governor of Lagos, accompanied by his staff, which includes Dr. Rowland as medical officer and botanist, and Mr. A. G. Fowler, whose services have been secured for the purpose of surveying and fixing positions by astronomical observations, left Lagos for the interior on January 3rd, 1893. As this part of Africa is very imperfectly mapped, it is hoped that good results may be obtained, especially as the party includes men quite capable of doing excellent work.

NORTH AMERICA.

Boundaries of Canada and the United States.—The text of a convention between Great Britain and the United States has just been published (Treaty Series, No. 16, 1892), which provides for a new survey of the frontier between Canada and Alaska, from its southern extremity in 54° 40′ N., to the point where the boundary meets the 141st meridian of west longitude, the line of demarcation between Canada and peninsula Alaska. The work is to be a coincident or joint survey, as circumstances may decide, and the Commissions of both Governments will meet at Ottawa as soon as the necessary supplies are granted. The survey will serve as the basis for definitely settling the boundary. Another Commission is to be appointed to decide on a method of more accurately marking, by buoys or otherwise, the boundary-line between the two countries in Passamaquoddy Bay, which separates the coast of Maine from that of New Brunswick.

Climate of Death Valley, California.—A recent bulletin of the American Weather Bureau contains some notes on the climate of Death Valley, California, which are of interest as describing the most perfect development hitherto met with of the climatic conditions peculiar to valleys. Death Valley lies on the northern

margin of the Mohave Desert, between the Panamint Mountains on the west side, and the Funeral and Amargosa Ranges on the east. The former attains a height of 8000 or 9000 feet, and the latter of about 5000 feet. Its length is about 75 miles; breadth, 20 to 25 miles from crest to crest; and about half as much across the bottom at its widest part. At the observing station the breadth was 6 miles. The valley runs nearly north-north-west to south-south-east, and has generally been supposed to extend some few feet below sea-level, although the more recent barometric observations do not support this conclusion. The valley proper is probably the bed of a former lake of bitter water. A thin crust of salt runs along the east side, and in the bottom there is a salt marsh, destitute of vegetation, and bordered by slopes sparsely covered with shrubs and cacti. Another salt marsh, covered with tall coarse grass, occurs at the northern end. The sand is bare and white, shifting easily. The surroundings are evidently such as to isolate a large body of air in the valley and to expose it to excessive radiation. Meteorological observations were begun on April 30th, 1891, and continued till the end of September. The 5.13 A.M. and 5.13 P.M. observations of temperature give the following monthly means: May, 84°·7; June, 92°·1; July, 102°·1; August, 100°·8; September, 90°·2; the highest temperature observed was 122°, and the lowest, 54°; average daily range, 23°·6. The records show a hot spell from July 18th to 24th, when the daily mean did not fall below 106°·4, and averaged 107°·5. The amount of moisture is remarkably constant throughout, averaging 3·56 grains per cubic foot. The highest relative humidity observed was 75 per cent., and the lowest, 5 per cent.; average at morning observations, 30·5; evening, 15·6. Hence it appears that temperature was never less than 9° above the dew point, while for the most part the dryness was intense. These facts gain much significance from a study of the wind observations, which show a strong preponderance of up-valley winds (south and south-east), and these are not only the most frequent but markedly hottest and strongest. The south winds occur more than twice as frequently in the evening than in the morning, and the north winds less than half as frequently. On the whole, the frequency of up-valley winds is to that of down-valley as 5 to 1, which suggests that the valley, running north and south, tends to accentuate the monsoon influence which has already been recognised in South-eastern California. Of rainfall thirteen showers gave 1·40 inch, and nine left only a trace. Out of fifty hours of rain only fifteen occurred during the day, and the rain was wholly local in character. The chief interest of the pressure observations centres in the diurnal curve deduced from the apparently trustworthy records of a Richard barograph. The curve has a single maximum and minimum at 8 A.M. and 5 P.M., and a diurnal range of 0·082 inch, the most marked specimen of the valley type yet obtained. It is remarkable that the pressure variations give little or no clue to changes of weather, of which the outstanding features are gales, hot blasts, rain, and sand storms.

SOUTH AMERICA.

Brazilian Guiana.—A general description of the prairies (*Campos geraes*), oasis of *Mauritia rinifera* (*Buritisaes*), and forests of the large region called Brazilian Guiana, south of Venezuela and the Guianas, north of the Rivers Negro and Amazons, was published (1891, p. 276) by Senhor Gustavo da Suckow in the *Revista* of the Geographical Society of Rio de Janeiro. The centre of this country is the Rio Branco, an affluent of the Rio Negro. The *campos* extend from 1° 40′ N. lat. to

the Pakaraima and Kwimirapaka Mountains, where, at Santa Maria, Carmo, and Pesqueiro Real, remains of old Portuguese settlements are still to be seen. The fertility of the *campos*, which are there at a very short distance from British Guiana, and their capabilities for raising coffee, cotton, sugar-cane, tobacco and cereals, are extraordinary. The few white settlers in the country have already more than 20,000 head of cattle and 3000 horses. Gold is very abundant. An old legend says that the bottom of Lake Amacu, in the Pirarára *campos*, is entirely lined with gold. Some of the Indian tribes—Makushi, Mapishanas, Paushianas, Yuricunas, Porokotis—are more or less domesticated. The only wild Indians are the Masahys. Not far away in River Rupunuri (British Guiana) there are English missionaries. Senhor Suckow's paper includes the experience of Senhor Jose Paulino von Hoonholtz during three years' residence in those regions.

Explorations in the Beni Province.—Baron H. Arnous de Rivière contributes to the *Bulletin* of the American Geographical Society some notes on his journeys in this province in 1886. His interest having been aroused by accounts of the gold-bearing streams of the eastern slope of the Andes, he determined to explore the abandoned diggings and the best routes to them across the snowy range, which here culminates in the great peaks of Sorata (or Illampu), Huama-Potosí, and Illimani. By tracing the course of the streams with compass and chain a fairly accurate map was produced, and the conclusion arrived at that a road could be easily made, and at a comparatively small cost. It would have, however, to be cut through the forest, following the river's course as nearly as possible, none of the existing paths being capable of utilisation. Of these there are four, details of which are given. Some are badly traced; while the fact that part of the way is done by water makes the journey in one direction perilous and slow. That which is at present in the worst condition takes, however, the best direction (along the Challana Valley); and it is this line which Baron de Rivière recommends as the best for connecting the Beni with La Paz. The latter town will eventually be connected with the Pacific by three railways; but for the present the shortest route to the Beni is by the Arequipa Railway to L. Titicaca, and thence *viâ* Huaichu, on its eastern shore, to the Mapiri River. This route avoids the perilous passage of the Andes at Sorata. In conclusion, the Baron deals with the natural resources of the Beni, and shows that the ideas of its unhealthiness are somewhat exaggerated.

Exploration of Venezuela.—The *Revue Française* states that Dr. Sievers of Giessen has received a grant of £400 from the Hamburg Geographical Society for explorations in the llanos of the Orinoko.

AUSTRALASIA AND PACIFIC ISLANDS.

Sir William Macgregor and the Islands South-East of New Guinea.—In a former despatch Sir William Macgregor supplied some notes regarding the little-known Kiriwina or Trobriand group of islands lying to the north of the D'Entrecasteaux group.* In the present despatch he gives the position of the north and south points of the principal island. His observations at Giriba, at the south end, gave a latitude of 8° 48′ 17″ S., while those at Bomatu, the Cap Denis of D'Entrecasteaux, at the north end, gave the latitude of that place as 8° 24′ 19″ S. The length of Kiriwina Island is therefore 24 geographical miles. Sir William draws particular attention to the fact that these positions as determined by D'Entrecasteaux correspond exactly in one case, and within 1′ in another with his own. The country between Kaibola and Bomatu at the northern end of Kiriwina, and also the neighbouring island of Vakuta is composed of coral, is mostly flat and of extraordinary fertility. An inspection was also made of the coast between Wedan and Radawa on the north-east coast of the possession. Between these places there are stated to be no coast villages. A line of mountains apparently about 4000 feet high, runs parallel to the coast, their spurs in many places projecting into the sea. They seem to consist of basalt, but with many horizontal outcrops of coral limestone as far up the coast as Radawa. The population, mainly owing to the steepness of the land and the resulting rain-wash, have had to withdraw up the mountains as the soil below disappeared, and now appear to live at a height of 1500 to 2000 feet, on the lower margin of the forest that crowns the mountain-tops. At several places along the coast there are grassy plateaux at different elevations, apparently old sea margins. Two of the largest of these are situated at the head of Rabua (Goodenough Bay) on the south side. There appears to be a very considerable population along the north-east side of the bay distributed in small villages, which also extend inland. During the present visit, Sir William fixed the latitude of Dobu Station as, 9° 45′ 00″ S., and of the island of Tuwikike (with Tuwai, the Mosquito Islands of the chart) as, 9° 47′ 23″ S.

Changes in Kilauea.—On the occasion of an ascent of the summit of Kilauea (4250 feet) on the island of Hawaii, for the purpose of inspecting the lava lake there, Dr. Marcuse was able to make some important observations and measurements with regard to the upheavals and subsidences of the hot and cold lava masses, and he described his results in a paper to the December meeting of the Berlin Geographical Society. The map issued by the well-directed Hawaiian Land Survey of 1886 can scarcely be recognised again, in consequence of the immense changes which have taken place in the meanwhile in this active volcano. According to the data given, the edge of the crater has, within the last five years, been raised about 70 feet above the liquid lava.

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* *Vide Proceedings*, 1892, pp. 327, 328.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Relations of Soil to Climate.—Under the above title the United States Weather Bureau (Department of Agriculture) publishes a suggestive report by Prof. E. W. Hilgard, of the University of California in which an attempt is made to draw some several distinctions between the soils of arid and humid climates The author discusses the mechanical and chemical effects of different temperatures and amounts of rainfall upon soils derived from different formations, whether these remain in position or have been removed from the parent rock by glacial or other agencies. The influence of temperature is chiefly recognised by increased chemical activity in warm climates, and increased mechanical activity in continental climates where the range is great, and there is frequent freezing and thawing. The characteristic difference between the soils of humid and arid climates, so far as physical condition is concerned, is the extreme lightness or "dustiness" of the latter, and the similarity of the surface and subsoils. In the absence of sufficient rainfall little clay is formed, and that little is not washed down into a subsoil. Again, the formation of humus by the decay of vegetable matter goes on very slowly in arid regions, and the result leaves little residue beyond mineral ash, very different from the true black humus formed by decay underground in well-drained land, and the antithesis of the "sour" acid humus of peat-bogs. The greater part of the paper deals with the chemical action of rainfall by "leaching." Analyses of soils from nine "humid" and three "arid" States, excluding those in direct connection with calcareous formations, are compared. Evidence is adduced to show that in general carbonate of lime accumulates in arid regions, while in humid climates it is washed into the subsoils or into valleys; and, further, that climatic influences deal similarly with the agriculturally-less important carbonate of magnesia. It is then shown that the "insoluble residue" or sand with the lime is insufficient to account for all the soil ingredients, and that therefore the leaching process must extend further, to the formation of clay from felspathic minerals and, simultaneously, of complex hydrous silicates or zeolites. In these last potash is always retained more tenaciously than soda, and the latter only accumulates where the rainfall is exceedingly scanty as in the alkali lands of the arid regions.

CORRESPONDENCE.

The Ruins in Mashonaland.

15, Walmer Crescent, Glasgow.
Feb. 11*th*, 1893.

Sir,—What Dr. Schlichter says in his criticism of the "Ruined Cities of Mashonaland," regarding my contribution to that book, hardly seems to me satisfactory. He remarks, that what I have written does not strike him as furnishing the true key to the plans of the ruins; but he does not suggest any other solution, nor does he show that my key fails to apply to any of the features of the ruins. Besides, I do not base my statement regarding the bearing of the rising sun at the summer solstice, nor of the observation of meridian transits of stars, on the existence of the altar in the Great Temple—which I have described in the text as merely supposititious; but on the position of the centre of the arc A K. And I have shown that a point is always marked true north of the centre of every known arc in every

temple in Mashonaland. It is on this constant marking out of the meridian that I have based my statement regarding the observation of meridian transits.

I do not think that the position of the patterns on the outside of the temples was fixed on mathematical considerations, although the ends of the chevron pattern on the Great Temple happen to coincide with the points where the arcs change their radii, but I think that the purpose of this pattern was simply to decorate the part of the wall which faced the sun when rising at midsummer.

Regarding the orientation of the Great Temple, I would like to remark that, if the straight line through the centres of the arcs B K, A K*, and the great tower be continued, it will cut the outer line of the wall at its base, midway between B and K, which point let us call H. The distance from the centre of the great tower to H is equal to the semi-circumference of that tower; and the distance from H to the centre of the little tower is equal to twice its circumference; while the distance between the centres of the towers is equal to the diameter of the one, or the circumference of the other. Now, the line through H and the centre of the great tower, is the main axis of the temple, and the line from the same point through the centre of the little tower seems to be a true meridian line, and agrees very closely with the direction of the meridian observed with prismatic compass; in fact, if we apply the small correction necessary to make our observed meridian coincide with this, then the meridian line, from the centre of the arc A K (the altar (?)), through the main doorway, will pass through its centre, and will not lie against its eastern side, as it does in the plans. All this is not, however, readily apparent on the plans which have been published, for they are on much too small a scale. Admitting this method of orientation by the towers, the bearing of K from the altar (?) will be E. 23° 53′ 10″ S.

The accuracy of the orientation of the Great Temple gives us a measure of the accuracy of the work of its builders, and corresponds with the accurate mathematical construction of the ground plans of the temples. Although, unfortunately, when at Zimbabwe, we attached no importance to orientation, yet our observations (which have been confirmed by an independent observation, kindly taken by Sir John Willoughby) are sufficient to show that the bearing of the great stone on the hill from the doorway of the Great Temple, is true north to within 15′ of error, or even less; and I shall not be surprised if it is shown that the error is less than 5′.

With regard to Dr. Schlichter's criticism of Mr. Bent's historico-geographical remarks, and in my friend's absence from England, I would like to say that when Dr. Schlichter admits that the temples could not possibly have been built by African savages, and when he says that the principal authorities describe the territories south of the Zanzibar coast as almost entirely unexplored, he is hardly justified in disagreeing with Mr. Bent's statement that these authorities had no practical knowledge of the subject in hand.

I agree with Carl Ritter's remark, that these ruins will become the link for comparing ancient and modern geography; and I hope that we shall soon link them with some ruins of a better known civilisation.

Yours faithfully,

ROBERT M. W. SWAN.

The Editor of *The Geographical Journal*.

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* See plan of the Great Temple in the 'Ruined Cities of Mashonaland.' In the plan printed in the *Proceedings* of the Royal Geographical Society for May, 1892, K will be at the point where the solstitial line from the altar cuts the outer line of the wall about midway between A and B, and the centre of the arc B K will lie on a continuation of the straight line from the centre of the great tower through the altar and 70 feet distant from the altar.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1892-93.

Sixth Ordinary Meeting, January 30th, 1893.—The Right Hon. Sir MOUNTSTUART E. GRANT DUFF, G.C.S.I., President, in the Chair.

ELECTIONS.—*John Walwork Ashworth; Francis Pratt Barlow; Charles Caldwell Dallas; Thomas Alfred Greer, M.D.; Charles Grimes; Charles Forbes Harford-Battersby, M.A., M.D.; Frank Brinsley Harper; Maj.-General Adam G. Forbes Hogg, C.B. (Indian Staff Corps); Colonel Roland Bertram Lane; Hon. James Wilberforce Longley; Alfred Owen Lyon, B.A.; Arthur William Meers; Ernest George Meers; Robert Trail Omond; James Shand; Henry Eugene Wale; Charles Osborne West; William Lloyd Wise, J.P.*

The papers read were:—

1. "Journeys Round the Island of Yezo, and into the Interior." By A. H. Savage Landor.
2. "Journey Across the Island of Yezo." By Prof. J. Milne, F.R.S.

There was an exhibition of photographs, maps, etc., in the tea-room.

Seventh Ordinary Meeting, February 13th, 1893.—The Right Hon. Sir MOUNTSTUART E. GRANT DUFF, G.C.S.I., President, in the Chair.

ELECTIONS.—*Charles H. J. Acreb; William James Armitage; Frederick B. Ashton; Ralph Brocklebank; Archibald Campbell* (Scots Guards); *Lord Carew; William Clauson-Thue; Arthur Sidney Graves; Gilbert Edward Hutfield; Dr. Julius Klein, M.A.,; Colonel Alfred Thomas Mander, R.E.; Albert Davidson Michael; Mrs. Elizabeth Prentis Mortimer; Arthur Octavius Prickard, M.A.; Dr. Hugh Rayner; Frederick Henry Read Sawyer; Henry Stephen; Seymour Vandeleur* (Scots Guards); *Herbert Ward.*

The paper read was:—

"Twenty Years' Travel in South Central Africa." By F. C. Selous.

There was an exhibition of zoological specimens, photographs, etc.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By HUGH ROBERT MILL, D.Sc., *Librarian*, R.G.S.

EUROPE.

Austria—Carinthia. *Zeit. Ges. Erdkunde Berlin* **27** (1892): 349-396. **Frech.**
Die Gebirgsformen im südwestlichen Kärnten und ihre Entstehung. Von Dr. Fritz Frech (Mit einer Kartenskizze, sieben Tafeln und einer Textabbildung).

A study of the causes which led to the present configuration of the Carinthian mountains and lakes.

Belgium—Campine. *Bul. Soc. Roy. Belge Geog.* **16** (1892): 516-544, 613-642. **Harou.**
Une Excursion en Campine. Par Alfred Harou.

Continuation of an exhaustive account of the Campine considered in all its aspects and classified with a high degree of sub-division. History predominates.

Belgium—Scheldt. *Bul. Soc. Roy. Belge Geog.* **16** (1892): 453, 587–611. **Van Werveke.**

Etude sur le cours de l'Escaut et de la Lys-Durme au moyen age. Par A. K. Van Werveke.

A laborious study, with several maps, of the changes which have taken place during historic times in the hydrography of the Scheldt and Lys.

Corsica. **Barry.**

Studies in Corsica, sylvan and social. By John Warren Barry, M.A. London, Sampson Low, Marston & Co., 1893: 8vo, pp. xvi. and 302. *Map and illustrations. Presented by the Publishers.*

A leisurely account of leisurely wanderings through Corsica, with special regard to the distribution of forest trees in the island. Many of the facts of distribution, although not systematically treated, are of value, and the chapters on social life make the book a delightful one for those thinking over former tours to Corsica, or contemplating a visit. Mr. Barry writes with knowledge of his special subject.

Danube. **Gonda.**

La Regularisation des Portes de Fer et des autres cataractes du bas Danube. Rapport par M. Bela de Gonda. Paris, Lahure, 1892: large 8vo, pp. 80. *Plates and illustrations.*

A paper read to the Fifth International Congress of Inland Navigation held at Paris in 1892. It is specially noticed in the *Journal*, p. 237.

France—Brittany. *Ann. Geog.* **2** (1893): 173–188. **Gallouédec.**

Etudes sur la Basse-Bretagne. Le Pays de Léon. Par L. Gallouédec.

The *pays de Léon* is described with maps. It is the smallest division of Lower Brittany, and is peopled by the least altered Bretons.

France—La Crau. *Ann. Geog.* **2** (1893): 189–211. **Rainaud.**

La Crau. Par A. Rainaud.

A study, with large-scale map, of the pebbly plain of La Crau, lying between the western branch of the Rhone delta and the Etang de Berre.

France—Marseilles. *Bul. Soc. Geog. Marseille* **17** (1893): 5–10. **Roux.**

L'Etang de Berre. Par J. Charles Roux.

A proposal to convert the deep lagoon, known as the Etang de Berre, a few miles west of Marseilles, into a harbour, by dredging and improving the channel.

France—The Seine. **Babinet.**

Resumé des observations centralisées par la Service Hydrométrique du Bassin de la Seine pendant l'année 1891. Par M. Babinet, Ingénieur des Ponts et Chaussées. Versailles, 1892: large 8vo, pp. 68. *With a series of folio plates.*

A minute report of the rainfall, temperature, and water-level, of the Seine and its tributaries during 1891.

Germany—Alsace and Lorraine. **Gerland.**

Geographische Abhandlungen aus den Reichslanden Elsass-Lothringen. Mit Unterstützung der kaiserl. Regierung zu Strassburg, herausgegeben von Prof. Dr. G. Gerland. Erstes Heft. Stuttgart, Koch, 1892: 8vo, pp. 184.

This first part contains two memoirs on the physical geography of the district. Dr. R. Langenbeck discusses the earthquake phenomena of the Upper Rhine Valley and gives a list of recorded earthquakes. Drs. Hergesell, Langenbeck, and Rudolph, treat of the lakes of the South Vosges, describing, with maps, the six existing lakes, Weisser See, Schwarzer See, Sulzerner See, Stern-See, Belchen-See, and Sewen-See, with temperature observations on the first-named. They also describe a large number of former lakes, now dry.

Germany—Elbe. *Mitt. Verein Erdkunde Leipzig* (1891): 69–98. **Schreiber.**

Die Beziehungen zwischen dem Niederschlag in Böhmen und dem Wasserabfluss in der Elbe bei Tetschen. Von Prof. Dr. P. Schreiber in Chemnitz. *With two plates.*

The relation between the rainfall in Bohemia and the variations in level of the Elbe at Tetschen are brought out by means of curves for 1888, 1889, and part of 1890.

Turkey—Constantinople. **Elliott.**

Diary of an Idle Woman in Constantinople. By Frances Elliott. With map and illustrations. London, John Murray, 1893: 8vo, pp. [12] and 426. *Price* 14*s*. *Presented by the Publisher.*

An excellent picture of modern Constantinople, with brief dramatic summaries of the historical associations which invest the neglected sites of former greatness. The last chapter, dealing with the Bosphorus, is one of the best, showing the author's power of word-painting in great perfection. There is no hint of idleness either with regard to sight-seeing or historical study.

ASIA.

China. **Schlegel.**

Problèmes Géographiques. Les Peuples Etrangers chez les Historiens Chinois. II. Wen-Chin Kouo, Le Pays des Tatoués. III. Niu Kouo, Le Pays des Femmes. Par Gustave Schlegel. Leide, Brill, 1892: small 4to, pp. 24. *Presented by the Author.*

China—Pu-to. *Globus* **63** (1893): 117–122. **Franke.**

Die heilige Insel Pu-to. Von Dr. O. Franke.

India. **Lyall.**

The Rise of the British Dominion in India. By Sir Alfred Lyall, K.C.B., D.C.L. London, John Murray, 1893: 8vo, pp. xvi. and 288, *maps*. *Price* 4*s*. 6*d*. *Presented by the Publisher.*

A masterly survey of the recent history of India, written on a scale suitable for its purpose as a University Extension Manual, with due regard to historical perspective. The study stops with the completion of dominion in 1849.

India—Survey. ———

Synopsis of the result of the operations of The Great Trigonometrical Survey of India. Volume XXV. Descriptions and Co-ordinates of the Principal and Secondary Stations and other fixed points of The South-east Coast Series, or Series of the Southern Trigon. Prepared in the Office of the Trigonometrical Branch, Survey of India, Colonel G. Strahan, R.E., Deputy-Surveyor-General in charge. Published under the orders of Colonel H. R. Thuillier, R.E., Surveyor-General of India. Dehra Dun, 1891: 4to, pp. 114. Two charts. *Price* 2 *rupees.*

——— Volume XXVI. The Bombay Longitudinal Series, or Series B of the Southern Trigon. Dehra Dun, 1892: 4to, pp. 96. Two charts. *Price* 2 *rupees. Presented by the Secretary of State for India.*

Java. **Worsfold.**

A Visit to Java with an Account of the Founding of Singapore. By W. Basil Worsfold. London, Richard Bentley and Son, 1893: 8vo, pp. xii. and 284, *illustrations*. *Presented by the Publishers.*

Mr. Worsfold has written an unpretentious and practical guide to some of the sights of Java. It is not a guide-book in the ordinary sense of the term, but rather a book which would serve an intending visitor to the island as an excellent preparation for what he is likely to see and experience. The chapter on the Hindu temples is particularly interesting, and the many passing glimpses of native life are of some value.

Kurdistan. *Bul. Soc. Hongroise Geog.* **20** (1892): ap. 48–52. **Butyka.**

Les Kourdes de l'ouest et leur pays dans les contrées situées au nord-ouest de la Turquie-asiatique. Par D. Butyka.

Abstract of a long memoir in Hungarian, pp. 224–251 of the same volume.

Samos. **Stefani and others.**

Samos. Etude Géologique, paléontologique et botanique. Par le professeur Carlo de Stefani, le docteur C. J. Forsyth Major et William Barbey. Avec treize planches par Ch. Cuisin. Lausanne, Bridel & Co. 1891: 4to, pp. 100. *Price* 16*s*.

Contains a bibliography of Samos and an account of its botany and geology.

AFRICA

Africa—General. **Keltie.**

The Partition of Africa. By J. Scott Keltie, Assistant-Secretary to Royal Geographical Society. London, Stanford, 1893: pp. xvi. and 498. *Numerous maps. Price* 16*s. Presented by the Publisher.*

The object of this work is to give a connected history of the events which led to the partition of the greater part of Africa between a few European Powers. The early history of exploration and settlement in Africa is traced and illustrated by means of a series of maps on which the geographical conception of the continent current at different dates is represented in a novel and effective manner. Precise reference to the treaties which define the various spheres of influence make the original sources of all exact information readily available.

African Countries. **Malavialle.**

Le Partage politique de l'Afrique en Decembre 1891. Par M. L. Malavialle. 8vo, pp. 116. *Presented by the Author.*

A reprint from the *Bulletin* of the Languedoc Geographical Society at Montpellier. The development of European possessions in Africa is dealt with historically.

British Protectorates. **Waller.**

Heligoland for Zanzibar, or One Island full of Freemen for Two full of Slaves. By Horace Waller. London, Stanford, 1893: 8vo, pp. 52. *Price* 1*s. Presented by the Author.*

Egypt—Cairo. **Lane-Poole.**

Cairo; sketches of its History, Monuments and Social Life. By Stanley Lane-Poole. With numerous illustrations on wood by G. L. Seymour, Harry Fenn, J. D. Woodward, and others. London, J. S. Virtue & Co., 1892: square 8vo, pp. xvi. and 320. *Price* 12*s.* 6*d. Presented by the Publishers.*

This volume is, the author explains, in large part a collection of previously published writings. The separate essays give distinct glimpses of separate phases of Cairene life, while the many excellent illustrations display the types of people and of architecture. The last chapter deals with the results of the British occupation.

Gambia. *Bul. Soc. Geog. Com. Bordeaux* (1893): 1–13. **Rançon.**

Dr. Rançon. L'île de MacCarthy (Gambie).

Morocco. **Playfair and Brown.**

A Bibliography of Morocco from the Earliest Times to the end of 1891. By Lieut.-Colonel Sir R. Lambert Playfair, K.C.M.G., and Dr. Robert Brown, M.A. Royal Geographical Society Supplementary Papers, Vol. III., Part 3. London, John Murray, 1893: large 8vo, pp. 203–476. *Price to non-fellows* 5*s.*

This memoir may be obtained free on application by Fellows of the Society.

Portuguese East Africa. **Smith-Delacour.**

A Shironga Vocabulary: or Word Book on the Language of the Natives in the District of Delagoa Bay, south-east coast of Africa. Together with a map showing the district. Compiled by E. W. Smith-Delacour, H.B.M. Consul for Lourenço Marquez. London, Harrison & Sons: 1893, 8vo, pp. 32. *Presented by the Compiler.*

Uganda. ———

Uganda. By Philo-Africanus. 8vo, pp. 30. *Reprinted from Imperial and Asiatic Quarterly, January,* 1893.

NORTH AMERICA.

Hudson Bay. *Journ. Roy. United Service Inst.* **37** (1893): 29–39. **Miller.**

An Old Log. By Francis H. Miller.

Account of the voyage of H.M.SS. *Furnace* and *Discovery* for the purpose of discovering a passage from Hudson Bay to the South Sea in 1741–42.

Mexico—Tampico. *Bul. Soc. Geog. Com. Havre* (1892): 370–308. **Voizot.**
Tampico et les travaux du Pañuco. Paul Voizot.

Describes a plan for improving the river-harbour of Tampico.

United States. *Science* **21** (1893): 15–17. **Powell.**
The Work of the United States Geological Survey. By J. W. Powell, Director.

The Geological Survey of the United States includes as a preliminary the topographical survey of the public lands, the arrangements for which are described.

United States—California. **Harrington.**
Notes on the Climate and Meteorology of Death Valley, California. By Mark W. Harrington, Chief of the Weather Bureau. (Bulletin No. I. Weather Bureau, United States Department of Agriculture). Washington, 1892: 8vo, pp. 50. *Presented by the United States Weather Bureau.*

United States—Minerals. **Day.**
Mineral Resources of the United States. Calendar years 1889 and 1890. David T. Day, Chief of Division of Mining Statistics and Technology. (Department of the Interior. United States Geological Survey.) Washington, 1892: 8vo, pp. viii. and 672. *Presented by the United States Geological Survey.*

From this useful report we learn that in 1890 the output of pig-iron for the United States exceeded 10 million tons and of coal 141 million tons (the ton of 2000 lbs. is used), the output of iron exceeding that of Great Britain. The statistics are well arranged for ready reference.

SOUTH AMERICA.

General. *Ausland* **66** (1893): 11–14, 26–28, 41–44, 51–59. **Thering.**
Die Paläo-Geographie Südamerikas. Von H. von Thering (Rio Grande do Sul).

A sketch of the geological conditions of the continent, and of its geographical evolution, based largely on the phenomena of fossil and recent plant and animal distribution.

Andes. *Zeitsch. Ges. Erdkunde, Berlin* **27** (1892): 249–348. **Brackebusch.**
Die Kordillerenpässe zwischen der Argentinischen Republik und Chile, vom 22° bis 35° S. B. Von Prof. Dr. Ludwig Brackebusch.

A comprehensive review of the passes across the Andes, between Chile and the Argentine Republic, with a map.

Bolivia. **Quijarro.**
Los Territorios del Noroeste de Bolivia. Vias de comunicacion que les corresponden. Por el Dr. Antonio Quijarro. Buenos Aires, 1892: 8vo, pp. 43. *With map. Presented by the Author.*

Ecuador. *Verhand. Ges. Erdkunde, Berlin* **19** (1892): 508–527. **Wolf.**
Herr Dr. Theodor Wolf: Ueber das westliche Tiefland Ecuadors.

See abstract in *Geographical Journal* for February, p. 154.

Guatemala. *Pet. Mitt.* **39** (1893): 1–14. **Sapper.**
Beiträge zur Ethnographie der Republik Guatemala. Von Dr. Karl Sapper in Coban.

Guatemala. *Zeitsch. deutsch.-österreich. Alpenvereins* **23** (1892): 367–392. **Sapper.**
Das Kettengebirge von Mittelguatemala. Von Dr. Carl Sapper.

AUSTRALASIA AND PACIFIC ISLANDS.

Hawaii. *Verhand. Ges. Erdkunde, Berlin* **19** (1892): 492–508. **Marcuse.**
Herr Dr Adolf Marcuse: Die Erdmessungs-Expedition nach den Hawaiischen Inseln.

See extract in *Geographical Journal* for February, p. 173.

New Guinea. **[MacGregor.]**

Handbook of Information for Intending Settlers in British New Guinea. Published by Authority. Brisbane, 1892: 8vo, pp. 34. *Map.*

Sir William Macgregor has drawn up an authoritative sketch of the laws in force in New Guinea, with full extracts of the statutes relating to the acquisition of land, to labour, and to the Customs tariff.

New Hebrides. **Somerville.**

A Vocabulary in Various Dialects used in some islands of the New Hebrides, South Pacific. Compiled from various sources by Lieut. Boyle T. Somerville, R.N. 1892: oblong, pp. 58. *Presented by the Hydrographer of the Admiralty.*

POLAR REGIONS.

Eskimo. **Nansen.**

Eskimoliv, af Fridtjof Nansen, med illustrationer af Otto Sinding. Kristiania: Aschehoug, 1891: 8vo, pp. viii. and 296. *Presented by the Author.*

Spitzbergen. **Nordenskiöld.**

Redogörelse för den Svenska Expeditionen till Spetsbergen, 1890, af G. Nordenskiöld. Stockholm, 1892: 8vo, pp. 94. *Plates. Presented by the Author.*

A reprint from the transactions of the Royal Swedish Academy of Sciences. The paper describes the author's work on a visit to Spitzbergen. Appendices give lists of some of the plants and animals collected, tables of temperature observations in the fjords, and a description of the series of fine photographs of glaciers with which the memoir is illustrated.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Ground-water. **King.**

Observations and Experiments on the Fluctuations in the Level and Rate of Movement of Ground-water on the Wisconsin Agricultural Experiment Station Farm, and at Whitewater, Wisconsin. By Franklin H. King (Bulletin No. 5 of the Weather Bureau, U.S., Department of Agriculture). Washington, 1892: 8vo, pp. 76. *Numerous illustrations. Presented by the U.S. Weather Bureau.*

Maps. **Basevi and Fritzsche.**

A. Basevi. G. E. Fritzsche. La Rappresentazione orografica a Luce Doppia nella cartografia moderna. Roma: Instituto Cartografico Italiano, 1892: 8vo, pp. 24. *With plate. Presented by the Authors.*

A paper on mountain shading read to the Geographical Congress at Genoa.

Photographic Surveying. *Comptes Rendus* **116** (1893): 232–235. **Laussedat.**

Sur les progrès de l'art de lever les plans à l'aide de la Photographie, en Europe et en Amérique. Note de M. A. Laussedat.

Notes on the use of photography in the Survey of the land bordering the Canadian Pacific Railway by Mr. Deville.

Soil. *Pet. Mitt.* **39** (1893): 17–19. **Tillo.**

Die geographische Verteilung von Grund und Boden. Von Dr. Alexis von Tillo, Generalmajor.

A calculation of the area of the Earth's surface occupied by each variety of soil or superficial deposit.

Soil and Climate. **Hilgard.**

A Report on the Relations of Soil to Climate, by E. W. Hilgard, Professor of Agricultural Chemistry, University of California (Bulletin, No. 3, Weather Bureau, U.S. Department of Agriculture). Washington, 1892: 8vo, pp. 60. *Presented by the Weather Bureau.*

Volcanoes. **Daubrée.**

Application de la méthode expérimentale au rôle possible des Gas Souterrains dans l'histoire des Montagnes Volcaniques. Par A. Daubrée. Paris, 1892: 8vo, pp. 28. *Presented by the Author.*

M. Daubrée succeeded in perforating pieces of different kinds of rock by exploding a small charge of dynamite or cotton-powder in a strong vessel closed by a slice of the rock in question. The results led him to regard explosions of subterranean gases as the origin not only of volcanic vents, but of the singular clay-filled tunnels which are a feature of the South African diamond-fields.

Volcanic Phenomena. **Reyer.**

Geologische und Geographische Experimente. Von Ed. Reyer II. Heft. Vulkanische und Massen-Eruptionen. Leipzig, Engelmann, 1892: 8vo, pp. 56. *Presented by the Author.*

A series of experiments reproducing on a small scale some of the movements of strata associated with volcanic outbursts, and illustrated by 215 diagrammatic figures.

Winds and Currents. *Verhandl. Ges. Erdkunde Berlin* **20** (1893): 63–87. **Schott.**

Herr Dr. Gerhard Schott: Eine Forschungsreise auf einem Segelschiff nach den ostasiatischen Gewässern. *With map of route.*

A summary of this paper appears elsewhere.

GENERAL.

Barometric Pressure. **Cole.**

The Diurnal Variation of Barometric Pressure. By Frank N. Cole, PH.D. (Bulletin No. 6. Weather Bureau, United States Department of Agriculture). Washington, 1892: 8vo, pp. 32. *Presented by the Weather Bureau.*

A mathematical discussion dividing the daily curve of pressure into three components with periods of twenty-four, twelve and eight hours, by harmonic analysis. Dr. Buchan's recent explanation of the diurnal phenomena is not referred to.

Bibliography. **Cardon.**

Pubblicazioni Geografiche stampate in Italia fra il 1800 e il 1890. Saggio di Catalogo compilato da F. Cardon. Roma, Societa Geografica Italiana 1892: 8vo, pp. xx. and 310. *Presented by Miss Cust.*

A catalogue of the Italian geographical works of this century prepared for the Geographical Congress at Genoa.

Biography—Breusing. *Verhandl. Ges. Erdkunde, Berlin* **19** (1892): 527–532. **Wagner.**

Arthur Breusing von Hermann Wagner.

Another biographical notice by Eugen Gelcich, with portrait, appears in the *Deutsche Rundschau* **15** (1893), 230–232.

Biography—Joule. **Reynolds.**

James Prescott Joule. By Osborne Reynolds, LL.D., F.R.S. Memoirs and Proceedings of the Manchester Literary and Philosophical Society, Vol. VI., Fourth Series. Manchester, 1892: 8vo, pp. 196. *Price* 10*s.* 6*d.* *Presented by the Literary and Philosophical Society.*

Capistran's Chronicle. *Ymer.* (*Dec.*, 1892): 21–43. **Bildt.**

Den s. k. Capistrani krönika i Chigianska biblioteket i Rom. Af. C. Bildt.

A discussion of the pretended Chronicle of John Capistran in the Chigi library at Rome, with facsimiles of two pages, and transcription of part of the Latin text relating to Norway, Iceland, and Vinland.

Colonies. **Beadon.**

The Solution of the Colonial Question. By Robert Beadon. Large 8vo, pp. 20. *Presented by the Author.*

Reprinted from the *Imperial and Asiatic Quarterly Review*, January 1893.

Columbus. *Bul. Soc. Roy. Belge Geog.* **16** (1892): 553–587. **Du Fief.**

Christophe Colomb et la découverte de l'Amérique. Par J. du Fief. *With maps and illustrations.*

Educational. *Bol. Soc. Geog. Italiana* **5** (1892): 1031–1072. ———

A series of papers on the teaching of geography read at the Genoa Congress. The articles by Professors Bertacchi, Canevello, Dalla Vedova, and Pennesi, deal with geographical instruction in secondary schools and in universities.

Emigration. **Nery.**

L'Emigration et l'Immigration pendant les derniers années. Par F. J. de Santa-Anna Nery. Paris, Guillamin et Cie., 1892: 8vo, pp. 76. *Price* 1 *fr. Presented by the Author.*

A study on emigration chiefly to the United States and Brazil, from France and Italy, read to the Geographical Congress at Genoa.

Geographical Congress. ———

Il Congresso Geografica Italiano. Relazioni su alcune tesi e Communicazioni da presentarsi alla Sezione Prima del Congresso, Autori Bianchi, Botto, Dobrn, Fiorini, Grablovitz, Marinelli, Paganini, Roncagli, Sergi. Roma, Societa Geografica Italiana, 1892: 8vo. pp. 112.

Ibid. Sezione Seconda, Autori Carerj, Corte, Magliano, Rossi, Scalabrini, Sitta, Vedovelli, Volpe-Landi, pp 68.

Ibid. Sezione Terza, Autori Bertacchi, Canevello, Marinelli, Pennesi, Porena, pp. 86. *Presented by Miss Cust.*

German Colonies. **Meinecke.**

Koloniales Jahrbuch. Herausgegeben von Gustav Meinecke, Fünfter Jahrgang. Das Jahr 1892. Berlin, Heymann, 1893: 8vo, pp. 308. *Price* 10*s.* 6*d.*

Apart from special papers on the German colonies there is an article of some general importance on the effect of tropical climates on Europeans, by Dr. O. Schellong.

Maps. **Ruge.**

Die Entwickelung der Kartographie von Amerika bis 1570. Von Dr. Sophus Ruge. Gotha, Perthes, 1892: 4to, pp. 86, *maps. Price* 5 *marks.*

Ergänzungsheft, No. 106 of *Petermann's Mitteilungen*, which will be specially noticed.

Models. *Scot. Geog. Mag.* **9** (1893): 83–87. **Goodchild.**

Notes on the Construction of Topographical Models. By J. G. Goodchild, H.M.'s Geological Survey.

A useful description of the construction of a large-scale relief model of Edinburgh, showing all the diversities of site. The method employed is in many respects novel, and seems likely to be capable of extensive use.

Military Geography. *Zeit. deutsch.-österreich. Alpenvereins* **23** (1892): 45–83. **Baumann.**

Das Kriegswesen im Hochgebirge. Von J. Baumann (k. b. Hauptmann).

Oriental Literature. **Schlegel.**

La Stèle Funéraire du Teghin Giogh et ses copistes et traducteurs Chinois, Russes et Allemands par G. Schlegel. Helsingissä, 1892: large 8vo, pp. 58. *Presented by the Author.*

Partition of the Earth. *Ausland* **66** (1893): 65–69. **Oppel.**

Die Teilung der Erde. Von A. Oppel (Bremen).

A general discussion of the areas and populations of the portions of the Earth occupied or claimed by organised governments and of those still unappropriated.

Pearls. **Calvert.**

Pearls: their origin and formation. By Albert F. Calvert. London, Milligan & Co.: 12mo, pp. 32. *Price* 1*s. Presented by the Author.*

NEW MAPS.

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London. **Bartholomew.**

New Plan of West London. By John Bartholomew, F.R.G.S. Scale 3·2 inches to 1 mile (stat.). J. Bartholomew & Co., Edinburgh, 1893. *Price 1s. Presented by the Publishers.*

Scandinavia. **Johnston.**

Map of Sweden, Norway, and Denmark. Constructed and engraved by W. & A. K. Johnston, Edinburgh and London. Scale 1:1,649,800, or 22·6 geographical miles to an inch. 2 sheets. *Presented by Messrs. W. & A. K. Johnston.*

Switzerland. **Stanford.**

Stanford's London Atlas Map of Switzerland. Scale 1:506,880, or 6·9 geographical miles to an inch. London: E. Stanford. *Price £2 2s. Presented by the Publisher.*

This is a special edition of a map of Switzerland, produced by sun engraving, which will afterwards appear in Stanford's New London Atlas. (See notice, p. 239.)

ASIA.

India and the East. **Bartholomew.**

Route Chart to India and the East, on Mercator's Projection. By John Bartholomew, F.R.G.S. Scale (Equa.) 1 inch to 5·5. J. Bartholomew & Co., Edinburgh, 1893. *Price 1s. 6d., on cloth. Presented by the Publishers.*

This is a nicely drawn little map, on which all the routes to India are laid down, with their distances in miles and the average time occupied on each route. Maps on an enlarged scale of the principal places visited on the voyage from England to India are given on insets.

AFRICA.

Africa. **Service Géographique de l'Armée.**

Carte de l'Afrique, à l'Echelle de 1 : 8,000,000, or 109·7 geographical miles to an inch. Dressée et publiée par le Service géographique de l'Armée. Paris, 1892. Sheets 5 and 6. *Price* 1 *fr.* 50 *cents. each sheet. Presented by E. Stanford, Esq.*

These two sheets contain South Africa and Madagascar; they are excellent specimens of cartography, and have been carefully brought up to date.

Africa. **Fees.**

Schulwandkarte von Afrika von Theodor Fees. 1 : 600,000, or 8·2 geographical miles to an inch. Wien, E. Hölzel. 6 sheets. *Price* 9 *marks.*

GENERAL.

The World. **Johnston.**

W. & A. K. Johnston's Royal Atlas of Modern Geography. Edition in monthly parts. Part 16. W. & A. K. Johnston, Edinburgh and London, 1892. *Price* 4*s.* 6*d. each part. Presented by the Publishers.*

The present issue of this atlas contains maps of China and Japan, and the north-east portion of a four-sheet map of the United States. An index to the map of China and Japan is given, but that for the map of the United States does not appear in the present part.

The World. **Cassell.**

The Universal Atlas. Complete in 28 parts, including Index. Published by Cassell & Co., Limited, London, for the Atlas Publishing Company, Limited. Part 23. *Price* 1*s. Presented by the Publishers.*

This part contains maps of Austria, Hungary, Polynesia, a West African Colonial map, and a portion of the index.

The World. **Juan de la Cosa.**

Facsimile of Juan de la Cosa's map of the World, A.D. 1500. By Señor Antonio Cánovas Vallego and Professor Traynor, Madrid, 1892. *Price* 18 *pesetas, with descriptive pamphlet.* (*Dulau.*)

At the present time, in connection with the Columbus celebration, there appears to be a laudable movement on the part of geographers to publish carefully executed facsimiles of ancient and rare maps at a moderate price, thus bringing them within reach of students of history and geography. The present reproduction of Juan de la Cosa's map is an example, and has the advantage of being a faithful copy as regards colouring, size, and every other detail. It is also accompanied by a well-written description of the map, and a biographical sketch of the author's life and voyages, which is printed in Spanish, French, and English.

World. **Santa Cruz.**

Map of the World by the Spanish Cosmographer Alonzo de Santa Cruz, 1542. Reproduction in phototypic facsimile by the printing office of the Swedish Staff-General. With explanations by E. W. Dahlgren, Secretary of the Swedish Society of Anthropology and Geography. Stockholm, 1892.

World. **Oppel.**

Erdkarte darstellend die Entwicklung der Erdkenntnis vom Mittelalter bis zur gegenwart in Stufen von Jahrhunderten entworfen und gezeichnet von Dr. Alwin Oppel. Mercator's projection. Equatorial Scale 1 : 20,000,000, or 204 geographical miles to an inch. Lithographie, Druck und Verlag der Topographischen Anstalt Winterthur J. Schlumpf, vormals Wurster, Randegger & Cie., in Winterthur. 6 sheets.

This is a six-sheet map of the World illustrating the progress of discovery from the earliest time to the present date. It is intended for the use of schools, is printed in colours and drawn in a style well suited to the purpose for which it has been published. Notwithstanding what the author says in his accompanying pamphlet, it is a pity that one rule was not adhered to throughout with regard to giving the names of explorers,

as there seems no sufficient reason why the names of early explorers might not have been given on every continent. This would have been a much better plan than giving some in America and Asia, and none in Africa. The boundaries of the Macedonian and Roman Empires are shown, together with the extent of the geographical knowledge of ancient and mediæval terms.

CHARTS.

North Atlantic Ocean. **U.S. Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean. February, 1893. Published at the Hydrographic Office, Bureau of Navigation, Navy Department Washington, D.C. *Presented by the U.S. Hydrographic Office.*

Oporto. **"O Commercio do Porto."**

Port of Leixões, New Harbour (Oporto, Portugal). Hydrographical Chart published by the daily paper *O Commercio do Porto*. According to the topography and soundings made by the Portuguese Government in the harbour, April, 1899; view of the entrance of the port; its situation in relation to the bar of the River Douro and the city of Oporto. 1892. Scale 1 : 2500, or 29·1 inches to a geographical mile. *Presented by the Associação Commercial do Porto.*

PHOTOGRAPHS.

Japan. **Milne.**

Thirty-four photographs of natives (Ainu) of Yezo Island, Japan. By Professor J. Milne, F.R.S. *Presented by Professor J. Milne.*

These photographs have been taken by Professor Milne, in the island of Yezo, and presented by him to the Society. They are of great interest, forming as they do a complete set of views illustrating the dwellings and appearance of the Ainu race.

Sikkim. **Hoffmann.**

Twenty-three Photographs of Mountain Scenery in Sikkim, taken by Theodore Hoffmann, Esq., 1892. *Presented by Messrs. Johnston and Hoffmann, Darjiling.*

This is an excellent series of photographs, taken by Mr. Theodore Hoffman, in Sikkim, and presented to the Society by that gentleman. The route followed by Mr. Hoffmann is described in the Royal Geographical Society *Proceedings*, September, 1892, and this account, with the accompanying sketch-map, will be useful for reference, as showing the points from which the photographs were taken. Among the most striking, are views of Tezong Waterfall, above Talung, the Talung Monastery, Cane Bridge, over the Teesta at Sanklan Sampo, Road between Sanklan Sampo and Sengthem, North Face of Siniolchu, Spur running north of Siniolchu, View on the east side of the Lungla-la, Snow Bridge over the Zemuchu, View from the Lungla-la, Kanchinjinga in the distance, North-east face of Kanchinjinga, Ice Caverns at the end of the North Kanchinjinga, Tibetan Encampment at Lo-nag. Although special mention has been made of the above, every view in the series is not only a beautiful specimen of photography, but, from a geographical point of view, gives a more accurate idea of the physical features and grand mountain scenery of Sikkim than could possibly be done by either a verbal or written description. It may be mentioned that Mr. Hoffmann has, on previous occasions, greatly increased the value of the Society's collection by his donations of photographs.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

113 30′ 114

5

SKETCH MAP

OF

BARAM DISTRICT

SARAWAK, BORNEO

BY

CHARLES HOSE

1884-1892

Scale of Miles

10 5 0 10 20 30

1 inch = 9·45 miles Natural Scale 1: 600 · 000.

Mr Hose's Route Red

Jungle Paths

Note: Places underlined thus: Baram Pt indicate where Natural History collections have been made.

30

C H I N A

S E A

Light House

Baram Pt

Tanjong Ratus

Tanjong Pinang

Lobok Kajaman

Tempuan Damit

Tempuan Masau

Oil Springs

500

Miri

Luak R.

Tukau R.

Bakam R.

Bakam

Mt Lambir

1550

Sandstone

Waterfalls

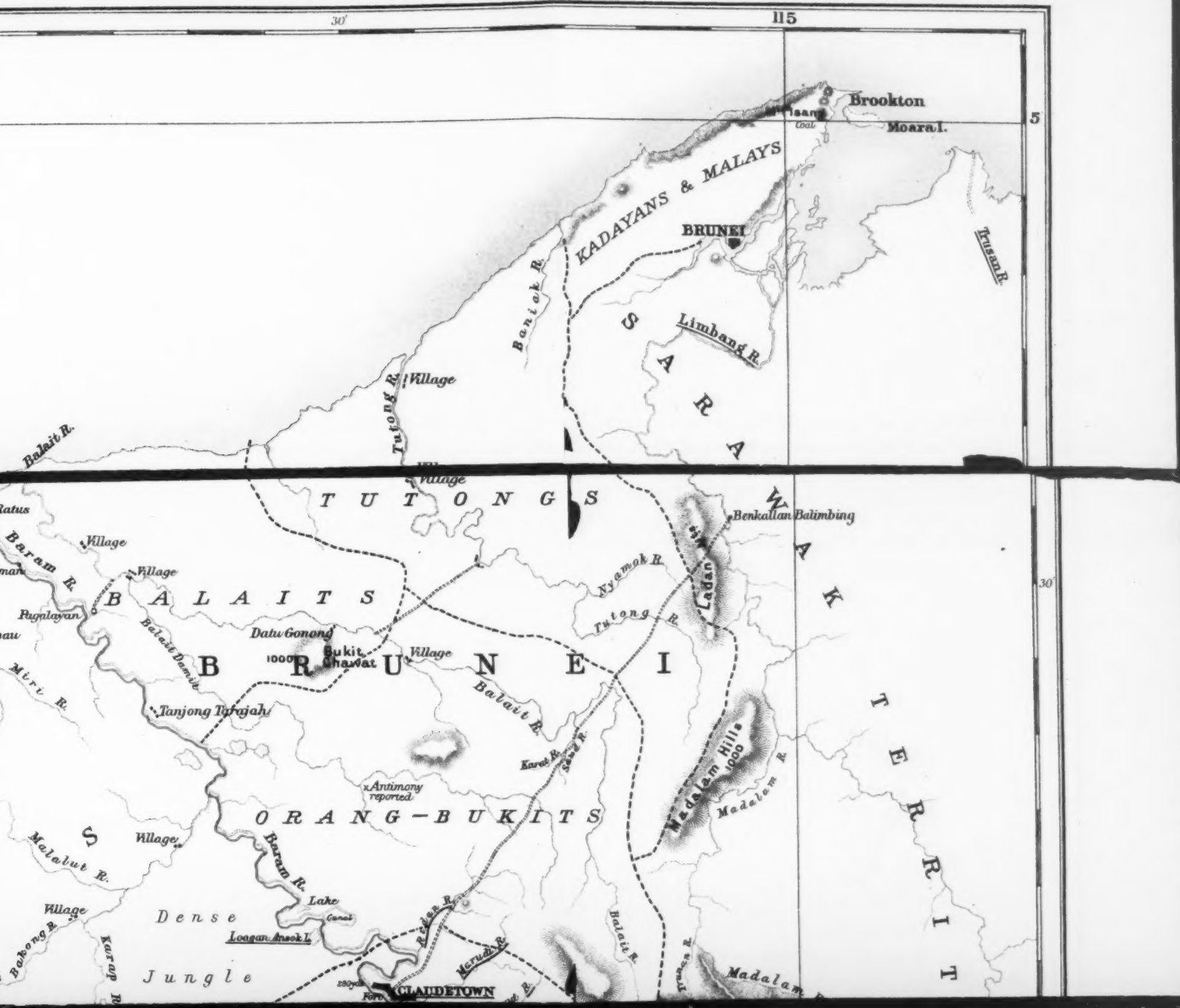
Sirwar R.

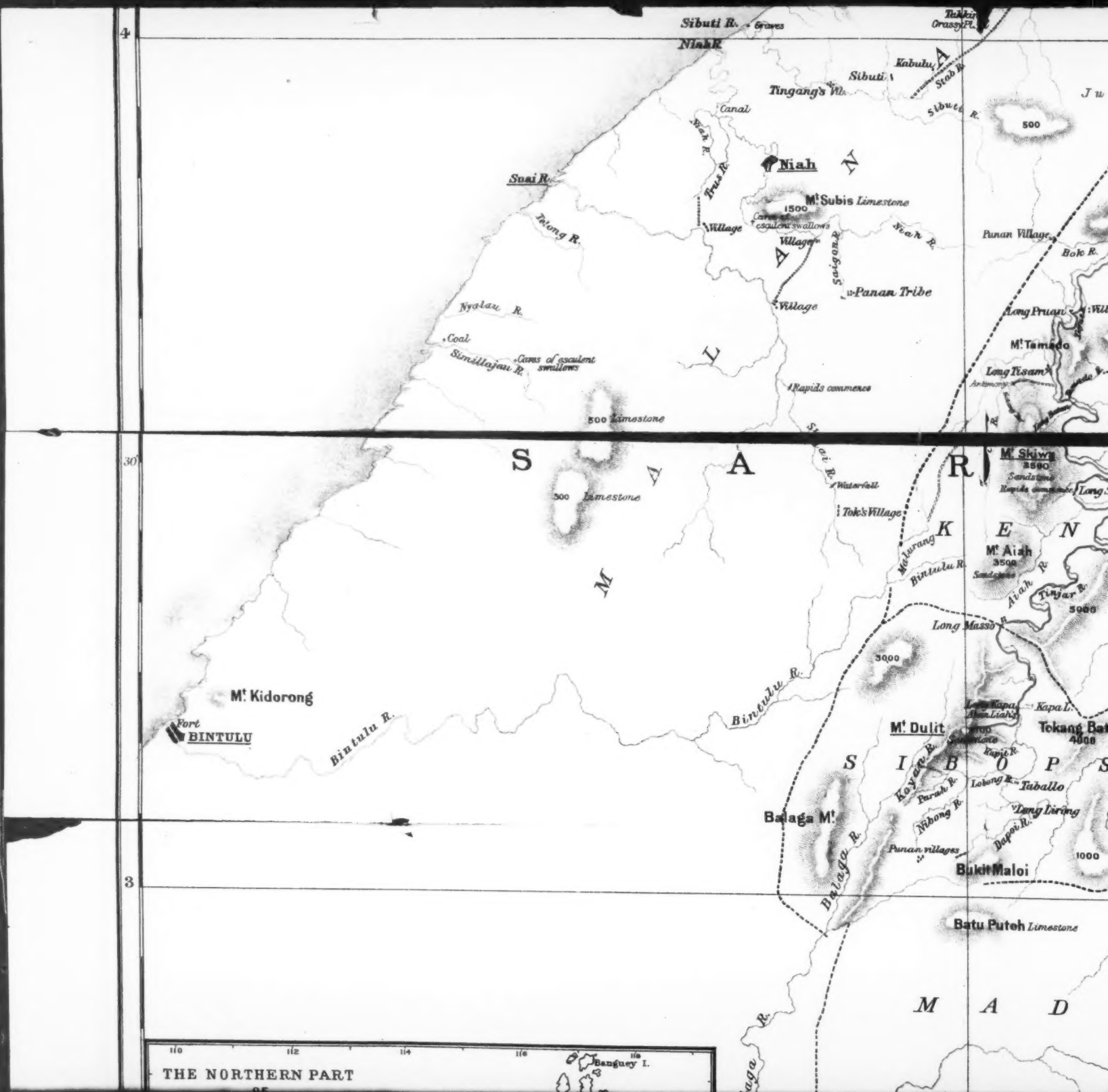
Lobong Burong

Cave of esculent swallows

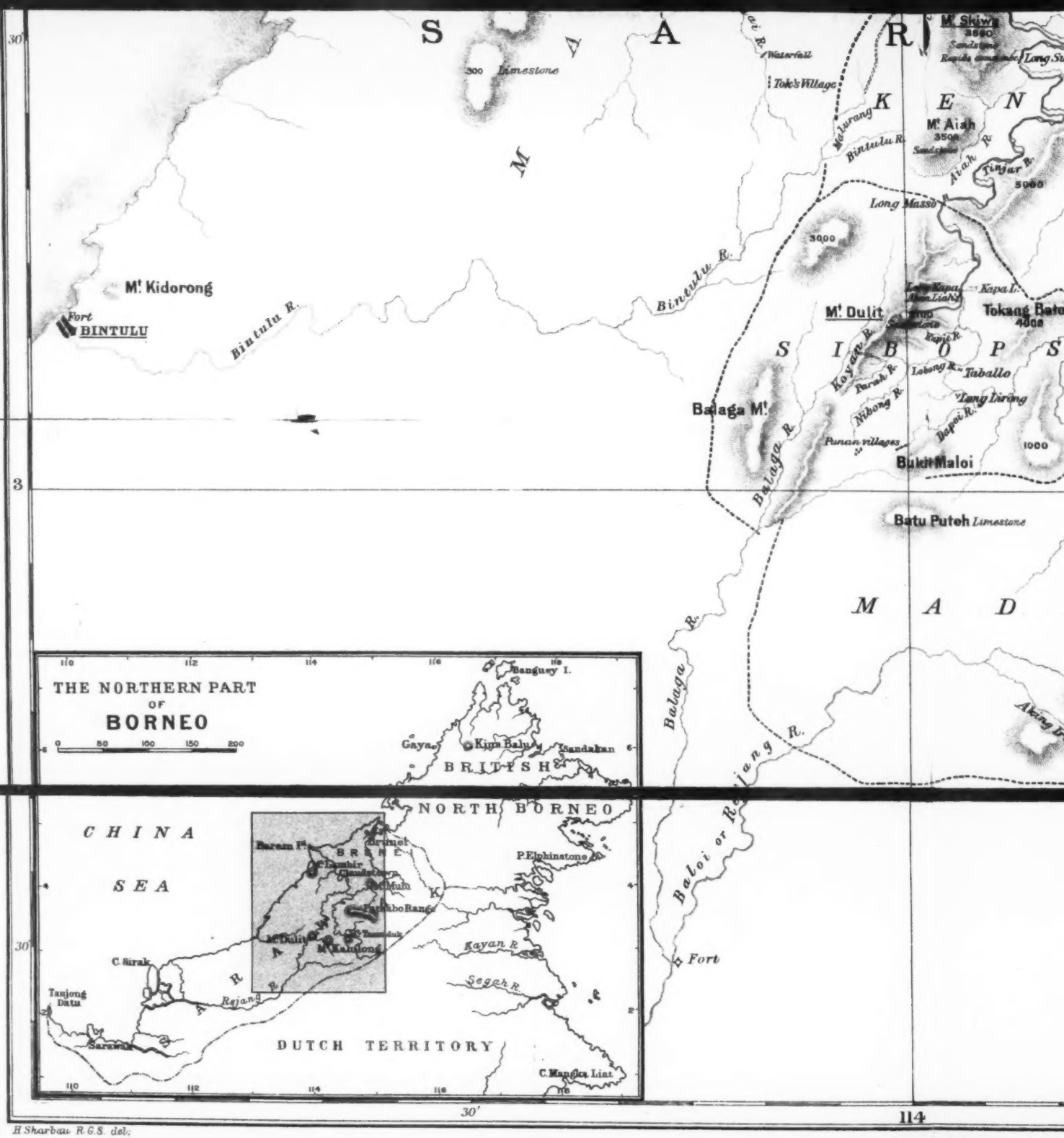
Tibap

Bungai


30'
115
5
Brookton
Coal
Moara I.
KADAYANS & MALAYS
BRUNEI
Trusan R.
Baniok R.
Limbang R.
S A R A W A K
Tutong R.
Village
Balait R.
T U T O N G S
Village
Village
Village
Baram R.
Pugalayan
B A L A I T S
Datu Gonong
Bukit Chawat
1000
B R U N E I
Village
Balait Damit
Miri R.
Tanjong Tarajah
Balait R.
Nyamok R.
Tutong R.
Ladan
Benkallan Balimbing
30'
Karet R.
Sand R.
Antimony reported
ORANG-BUKITS
Madalam Hills
1000
Madalam R.
T E R R I T
Malabut R.
Village
Baram R.
Lake
Canal
Dense
Jungle
Village
Bokong R.
Karap R.
Lonqan Anook I.
Belait R.
Meruda R.
Balait R.
Tutong R.
Madalam
CLAIDETOWN


Sibuti R.
Graves
Niah R.
Kabulu
Sibuti
Tingang's Vil.
Canal
Niah R.
Tris R.
Niah
Susi R.
Mt. Subis Limestone
1500
Caves of esculent swallows
Village
Village
Saigon R.
Niah R.
Tutong R.
Panan Village
Bolo R.
Panan Tribe
Village
Nyalau R.
Coal
Simillajau R.
Caves of esculent swallows
Rapids commence
500 Limestone
Long Pruan
Mt. Tamado
Long Tisam
Antimony
500
Limestone
Waterfall
Tok's Village
Mt. Skiwa
3500
Sandstone
Rapids commence
Long
Melarang R.
Mt. Aiah
3500
Sandstone
Bintulu R.
Aiah R.
Tinjar R.
5000
Long Masso R.
3000
Mt. Kidorong
Fort
BINTULU
Bintulu R.
Bintulu R.
Mt. Dulit
Kapa L.
Tapit R.
Koyan R.
Parah R.
Lobong R.
Taballo
Nibong R.
Long Liring
Dapoi R.
Balaga Mt.
Balaga R.
Punan villages
Bukit Maloi
1000
Batu Putoh Limestone
Balaga R.
110
112
114
116
118
Banguey I.
THE NORTHERN PART
4
30'
3

Lobok Nibong
Lobok Ayam
Loagan Rajoh R.
Tanjong Upak
Jungle
Village
Tinjar R.
Village
Tanah Panggal
Batu Blah
Waterfall
Limestone
Bad Rapid
Kalabit Villages
Pata R.
Kalabit Villages
Batu Song
Tama Bulan's
Long Mari Hills
Mt. Laki Sihan 3500
Mt. Salikan 3500
Pata Hills
Datu Tawak
Long Lutin
Giran Rapid
Mt. Giran
Village
Village
Village
Village
Waterfall
Caves of esculent Swallows
Mt. Salaan
Kalabit villages
Mt. Tahuduk
Flat top
Very bad Rapid
Mt. Kalulong 7000
Mt. Panawan 5000
6000
Baloi R.
Long Usan or Baram R.
Long Ilas or Baram R.
Selungo R.
Tutau R.
Tutau R.
Malinau Paku R.
Long Brunei R.
Apak R.
Kadayan Vil.
Long Tutau
Long Trusan
Canal
Sandstone
Limestone
Coal
Antimony
Coal
Lobok Ayam
Long Mari
Uma Baluan
Uma Bawang
Long Salat
Uma Belaing
Uma Jalong
Long Suking
Lawas R.
Mujan R.
Baluburan R.
Salaan R.
Libburu R.
Julaan R.
Lassah R.
Silad R.
Molu R.
Nabun R.
Tamaduk R.
Balada R.
Pawong or Tinjar R.
Trus R.
Lalak R.
Lame R.
Tutau R.
Sungai
Batu Gading
Long Tutau
Long Ikang
Long Trusan
Canal
Long Mari
Uma Balawang



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Waterfall
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Village
4000
2000
Mujan R.
Caves of esculent Swallows
Salaan R.
Kalabit villages
Mt. Salaan
Batok
Mt. Kalulong
7000
Mt. Tanuduk
Flat top
Very bad Rapids
Selungo R
Long Usan or Baram R.
Belaga R.
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Tamaduk R.
7000
4000
6000
Long Usan or Batam R.
Pauong or Tinjar R.
A N G S
Mt. Panawan
6000
Baloi R.
5000
6000
Sehai R.
High Land
Bakau R.
Marong R.
Metun R.
Uma Kulit Houses
Batang Kayan or Balungan R.
Iran R.
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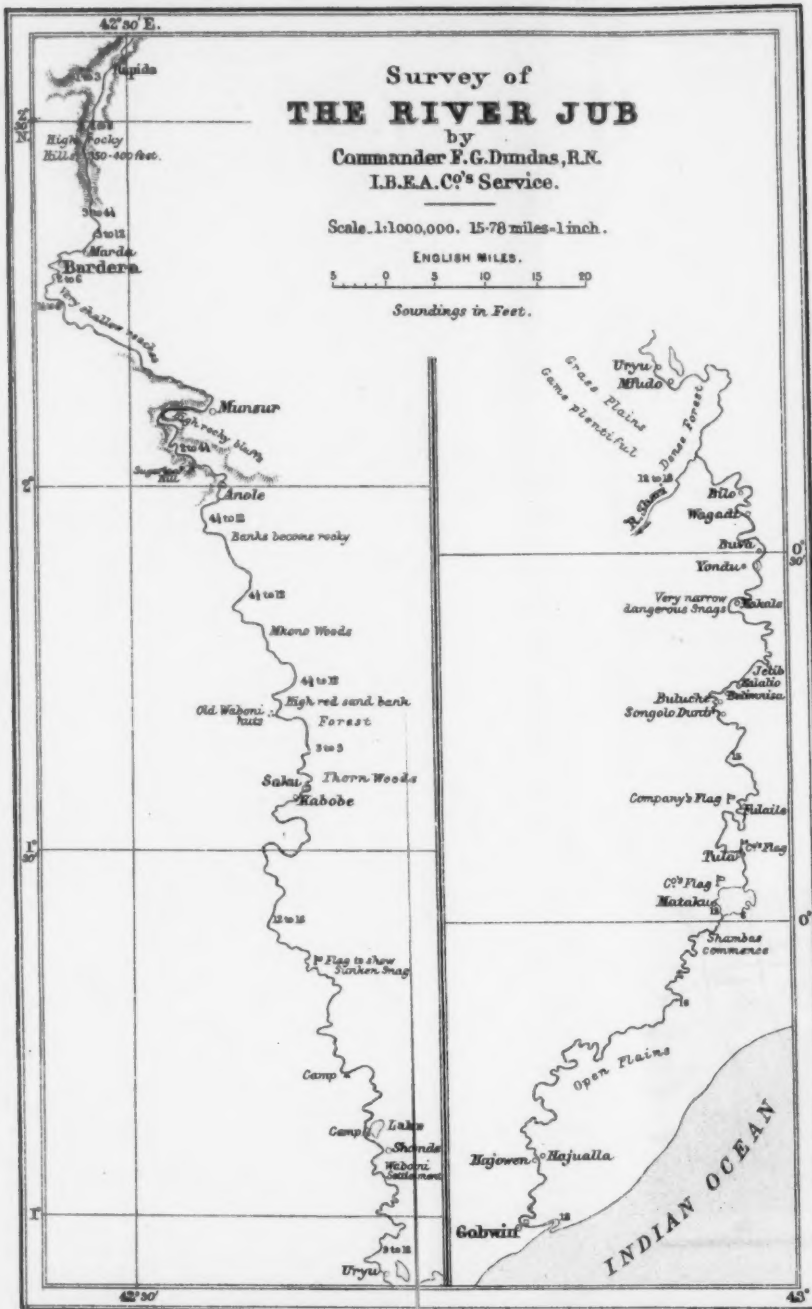
30'
Geographical Society



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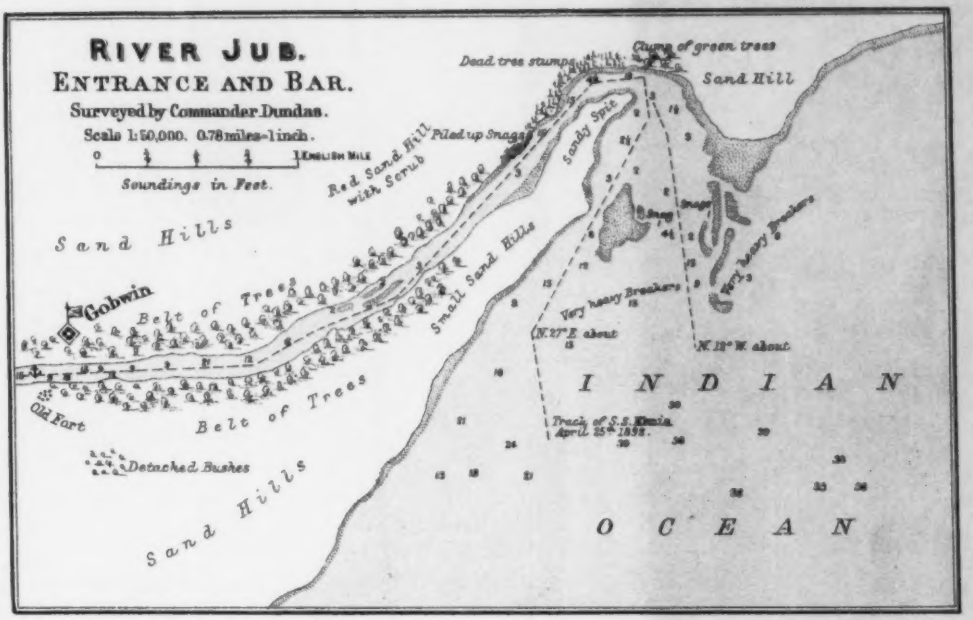

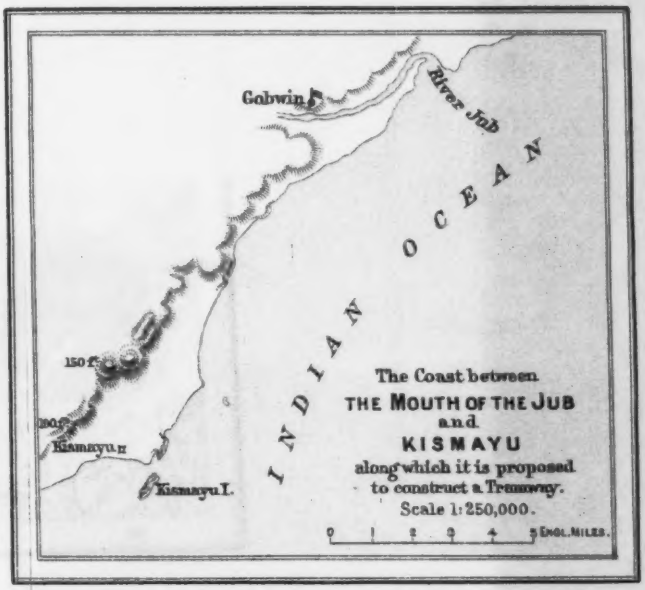

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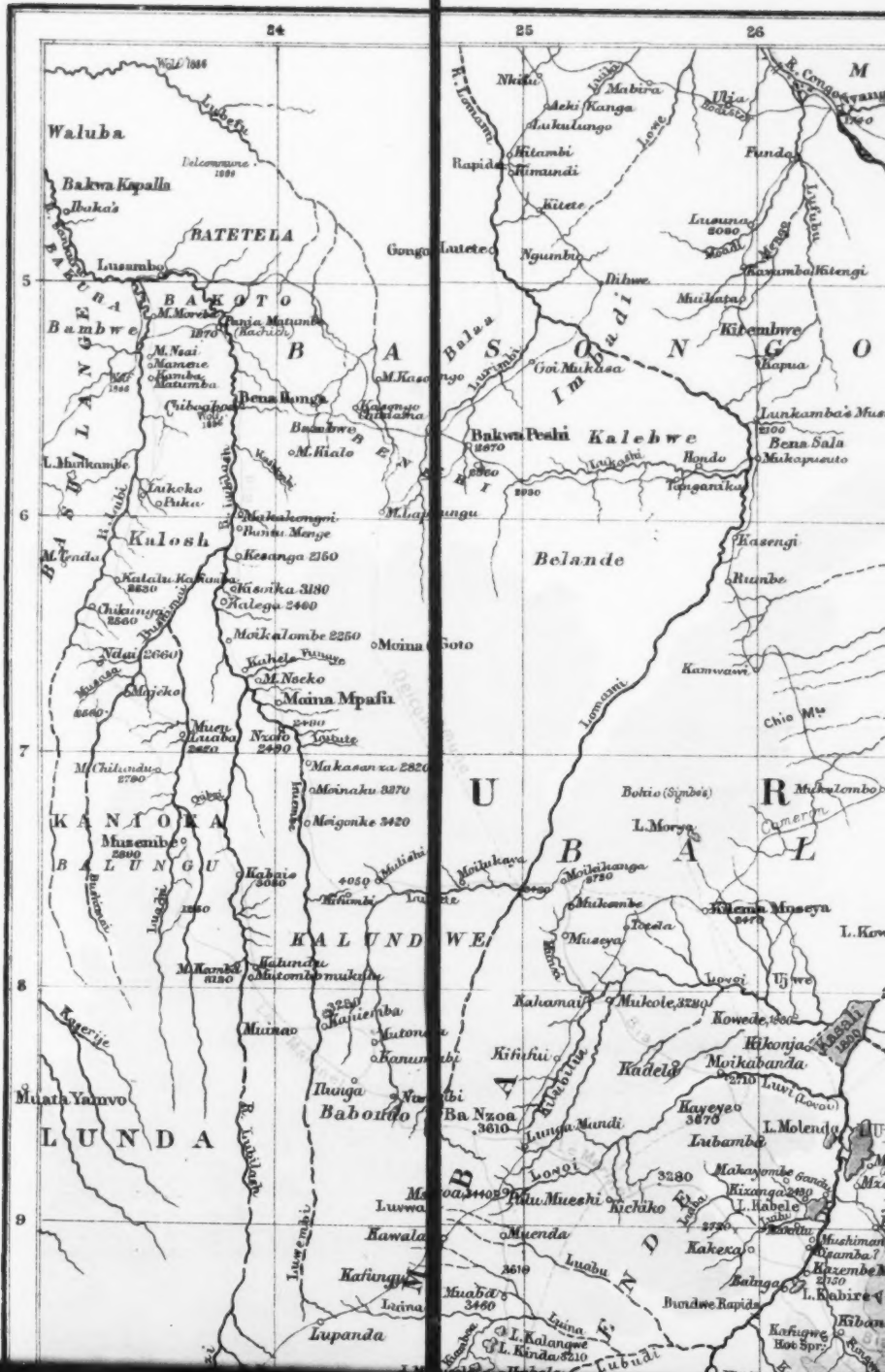
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Waluba
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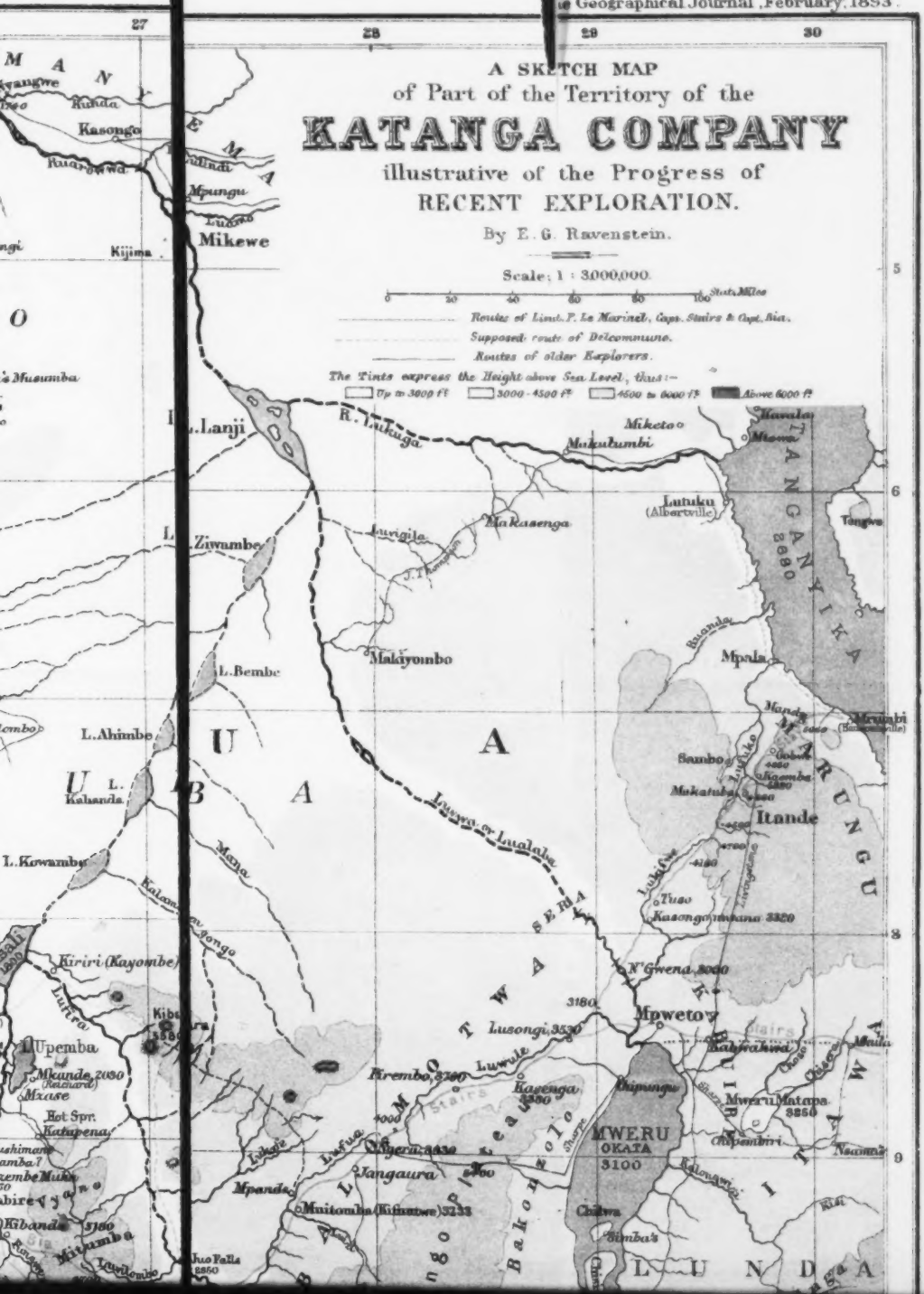
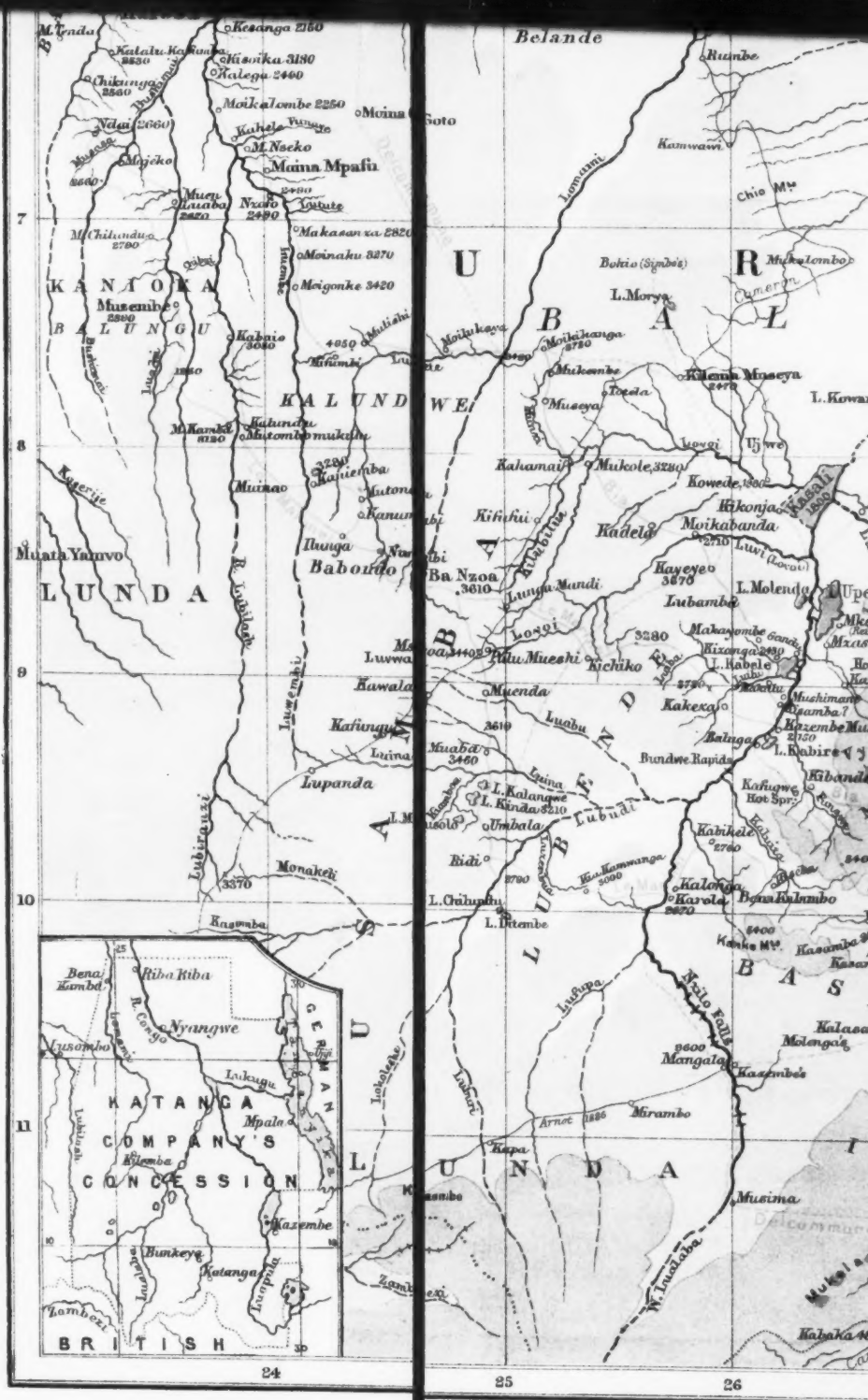
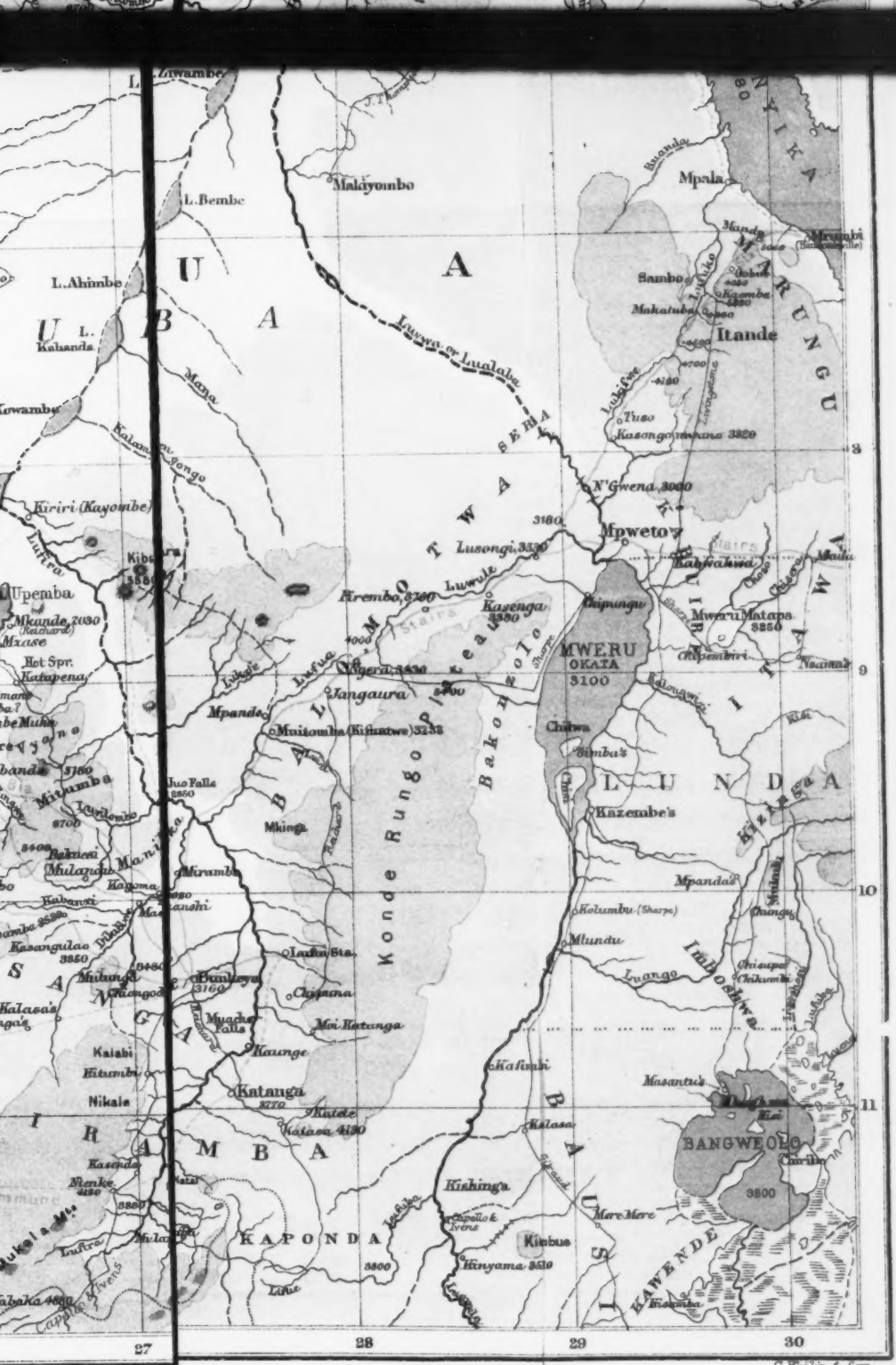
Bambwe
M. Mavia
Panja Matumba
M. Nsai
Mamene
Kamba Matumba
Bena Lunga
Chibo Island
M. Kiato
L. Munkamble
Lukoko
Puku
Malualengni
Punwa Manye
Kulosh
Kesanga 2150
Kasinka 3180
Kalega 2460
Moikalombe 2250
Moina Goto
Ndui 2660
M. Nacko
Majicko
Moina Mpafu
Nzalo 2490
Makasanza 2820
Moinaku 3370
Meigonke 3420
KANIOKA
Musembe 2890
BALUNGU
Kabwe 3080
4050
KALUNDWE
M. Kambi 3120
Kalundu
Mutombo mukulu
Muana
Kapuemba
Mutonda
Kanumbi
Muata Yamvo
LUNDA
Ilunga
Baboindo
R. Lubilash
Luwembi
Kafiangu
Luina
Lupanda
Nkula
Mabira
Aeki Kanga
Aukulungo
Kitambi
Rimandi
Rapids
Kitete
Ngumbi
Dibwe
Lusuna 3080
Kamamba Kitengi
Muilatac
Kitembwe
Kapua
S O N G O
Goi Mukasa
Imbadi
Bakwa Peshi 2670
Kalehwe
Bena Sala
Mukapusuto
Lukashi
Rondo
Tongaraka
Belande
Kasengi
Riumbe
Kamwawi
Chio Mts
U R U B A L E
Bokio (Simbo's)
L. Morya
Mukalombo
Cumene
Moikukaya
Moilelanga 3730
Mukombe
Kilema Museya
Museya
Lovoi
Ujwe
Kahamai
Mukole 3230
Kowede
Kikonja
Kadela
Moikabanda
Kayeyeo 3670
Luvi (Lovoi)
L. Molendu
Lubamba
Lovoi
3280
Makayombe
Kixanga 2340
Kikuluba
Ba Nzoa 3610
Lunga Mundi
Kitutu Mueshi
Kichiko
L. Kabele
Muenda
Kakexa
Luabu
Muaba 3460
Bundwe Rapids
L. Kalangwe
L. Kinda 3210
Lubudi
Kafugwe
Hot Spr.
Kiban
Mushiman
Kazembe
L. Kabire
Kasai
1850


A SKETCH MAP
of Part of the Territory of the
KATANGA COMPANY
illustrative of the Progress of
RECENT EXPLORATION.
By E. G. Ravenstein.
Scale: 1 : 3,000,000.
Statute Miles
Routes of Lieut. P. Le Marinel, Capts. Stairs & Capt. Bia.
Supposed route of Delcommune.
Routes of older Explorers.
The Tints express the Height above Sea Level, thus:—
Up to 3000 ft
3000-4500 ft
4500 to 6000 ft
Above 6000 ft
Mikewe
Kasongo
Kunda
Kijima
Lanji
R. Lukuga
Miketo
Mukulumbi
Mwana
Lutuku (Albertville)
Tongwe
TANGANYIKA 2880
Ziwambo
Lurigila
Makasenga
Makiyombo
L. Bembe
Mpala
Mirumbi
L. Ahimbe
L. Kalanda
Sambo
Makatuba
Itande
L. Kawambo
Lwena or Lualaba
Mona
Tuso
Kasongamwana 3320
Kiriri (Kayombe)
N'Gwena 3060
Upemba
Mkande 2090
Mxase
Hot Spr. Katapena
Mpweto
3180
Lusongi 3520
Firembo 3760
Luwule
Kasenga 3880
Chipungu
MWERU
OKATA
3100
Mweru Matapa 3850
Chipembiri
Mpanda
Muitomba (Kifuntwe) 3733
Yangaura
Chalwa
Simba's
Bakondo
LUNDA
Lufira
Lukafe
Kalamawiri
Nsamba
Mtamba
Kibanda 5100
Kiamba
Lwilombo
Lufira Falls 2850



Published for the Royal


Malayombo
L. Bembe
L. Ahimbe
Kahanda
Luwambo
Kiriri (Kayombe)
Kibara
Upemba
Mkunde 2030
Hot Spr.
Katapena
Mitumba
Mulanga
Kasangulaa 3850
Mukunga
Kalasa's
Kalabi
Kitumbi
Nikala
Kasenda
Manke
Mukoi's Mts
Kalaka 4800
Capello & Ivens
Mpala
Sambo
Makatuba
Itande
Luwua or Lualaba
Mana
Kalamba Songo
Tuso
Kasongo Mwana 3829
N'Gwena 3000
Mpwetoy
Lusongi 3530
Kirembo 3700
Luwule
Kayenga 3350
Mweru
Okata 3100
Mpanda
Mwitumba (Kifuatwe) 3233
Jangaura
Chiwa
Simba's
Kazembe's
Mpanda
Kolumbu (Sharpe)
Mlundu
Luanga
Bunkeya 3160
Chipama
Mwachet Falls
Mwi Katanga
Kaunge
Katanga 3770
Kalimbi
Kalasa 4130
Kishinga
Apollo & Ivens
Kinbus
Kinyama 3810
Mare Mere
Bangweolo
3800
Kawende
Kapanda
Lufira
Lufue
Lubige
Lubudi
Lufupa
Lukuga
Kasai
Kafue
Kalungwisi
Chambeshi
Luapula
Kalungwishi
Chimpungu
Mwaru Matapa 3250
Chipembiri
Nsamba
Kabwabwa
Chisupa
Chikumbi
Mwinilunga
Kabompo
Zambesi
Loangwa
Luitoshwa
Mpanda
Mukulu
Chiengi
Kabwabwa
Mpala
Mwamba
Mwamba
Mirambi
Buanda
Lukuga
Lufupa
Lufira
Lufue
Lubige
Lubudi
Kalungwisi
Chambeshi
Luapula
Kafue
Kasai